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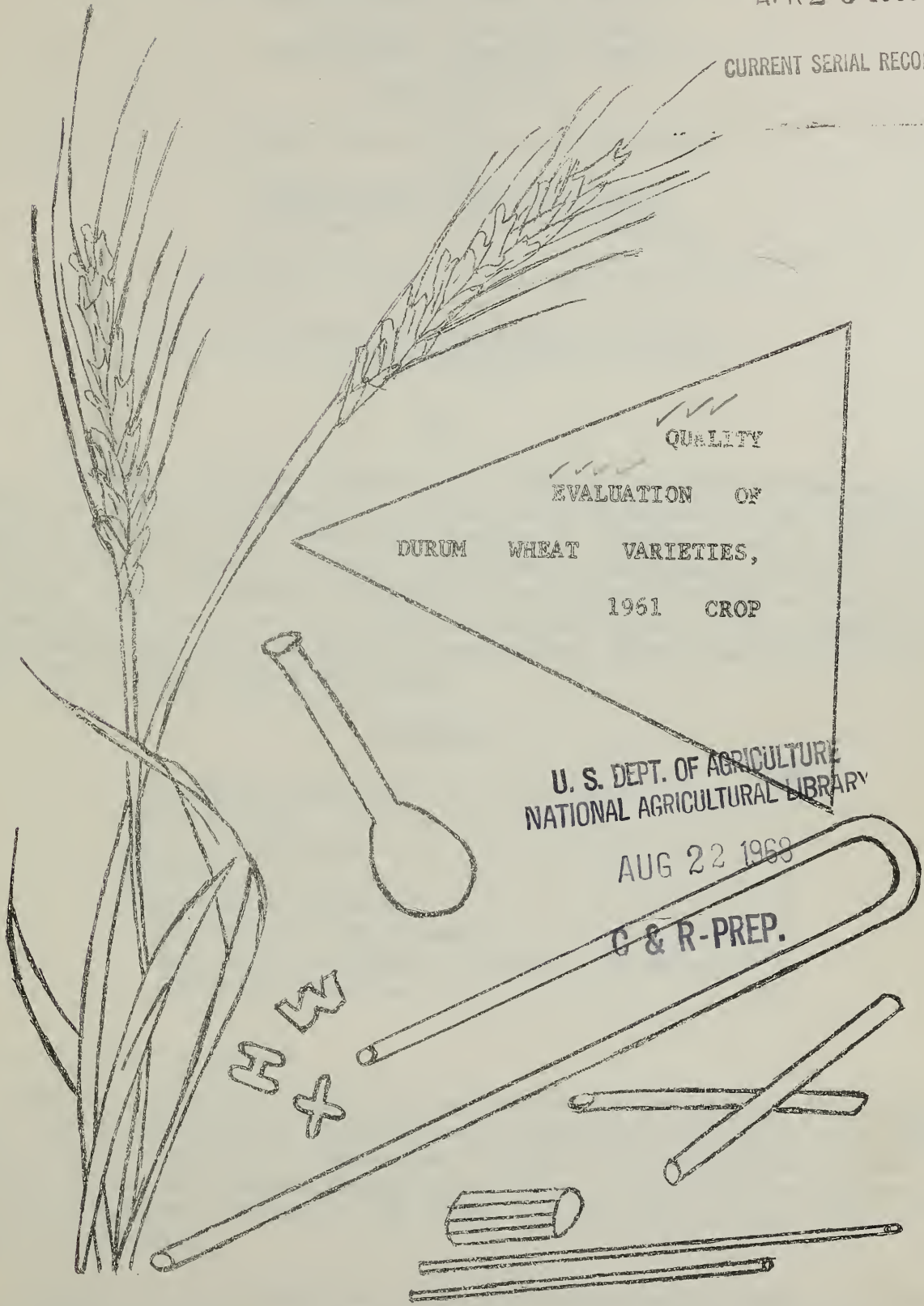


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UNITED STATES DEPARTMENT OF AGRICULTURE  
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Crops Research Division  
AGRICULTURAL MARKETING SERVICE  
Grain Division  
and  
Market Quality Research Division  
and  
NORTH DAKOTA STATE UNIVERSITY  
Department of Cereal Technology

\*--\*

Preliminary Report not for Publication 1/

QUALITY EVALUATION OF DURUM WHEAT VARIETIES  
1961 CROP 2/

by

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1/ This is a progress report of cooperative investigations containing data, the interpretation of which may be modified with additional experimentation. Therefore, publication, display, or distribution of any data or statements herein should not be made without written approval of the Crops Research Division, ARS, USDA, and the cooperating agency or agencies concerned.

2/ Cooperative investigations of the Crops Research Division, Agricultural Research Service, the Grain Division, and the Market Quality Research Division, Agricultural Marketing Service, and the Department of Cereal Technology, North Dakota State University. The samples were obtained from the cooperative experiments with the State agricultural experiment stations in the durum wheat region.





# COOPERATING AGENCIES, STATIONS AND PERSONNEL

The cooperating agencies, stations, and personnel conducting the varietal plot and nursery experiments concerned with these durum tests in 1961 were as follows:

## Minnesota Agricultural Experiment Station

St. Paul, Crookston, Morris: E. R. Ausemus\*, O. C. Soine,  
Roy Thompson

## North Dakota Agricultural Experiment Station

Langdon, Minot: K. L. Lebsock\*, Victor Sturlagson,  
G. N. Geiszler

## South Dakota Agricultural Experiment Station

Brookings, Watertown, Menno, Eureka, Cottonwood, Highmore,  
V. A. Dirks, D. G. Wells, Q. Kingsley

## Washington Agricultural Experiment Station

Pullman: Calvin F. Konzak

\* These are ARS employees





QUALITY EVALUATION OF DURUM WHEAT VARIETIES, 1961 CROP

CORRECTIONS AND ADDITIONS

- Table 2      Addition to footnote 1/, SK = Starchy Kernel
- Table 3      Addition of footnotes 1/, 2/, 3/, and 4/. These are listed at the bottom of this sheet for attachment to the manuscript.
- Table 3      Correction in Wheat Protein column, first figure listed should only read 17.4 instead of 17.K3 5/.
- Table 6      Addition of footnote 1/ below Numerical Rating heading.  
(Cont.)
- Table 7      No data available for footnote 4/
- Table 11     Addition of footnote reference 5/ under Numerical Rating column.

Footnotes to be attached to Table 3.

- 1/    A = excellent, H = fairly good, D = poor, B = blackpoint, F = heavy blackpoint.
- 2/    14.0 percent moisture basis
- 3/    Satisfactory score - 10.0; unsatisfactory - less than 8.0.
- 4/    7 gradations:    Very Strong - 8, Strong - 7, Medium Strong - 6,  
                         Medium - 5, Medium Weak - 4, Weak - 3, Very Weak - 2.



## INTRODUCTION

In years past, samples of the standard varieties and any new strains of durum wheat grown in cooperative experiments in the durum wheat region of the United States 3/ have been milled and evaluated by the United States Department of Agriculture in the Hard Red Spring and Durum Wheat Quality Laboratory at Beltsville, Maryland. This year due to the transfer of the Hard Red Spring and Durum Wheat Quality Laboratory to the campus of North Dakota State University at Fargo, North Dakota, not all the samples were processed in one laboratory or by United States Department of Agriculture personnel. All of the nursery samples were processed and evaluated at Beltsville. The other samples were processed at North Dakota State University in the Cereal Technology Department. Processing techniques and evaluation methods between the two locations were not identified, therefore, not all of the former data have been given in this report as in previous reports. Also, it has been necessary to change the methods of evaluation (not affecting ultimate gradings) to effect the compatability of scoring between the two laboratories. Therefore, it will be noted that in some instances different nomenclature has been used compared to previous years. Explanation of these changes are described in detail in the text of the report.

Where sufficient quantity of sample was available, the semolina was processed into macaroni to determine the quality characteristics. Other tests performed were dependent upon the quantity of semolina.

The purpose of this report is to make available to cooperators the quality data on standard varieties and new strains of durum wheat from the 1961 crop.

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3/ Ausemus, E. R. Results on spring wheat varieties grown in cooperative plot and nursery experiments in the spring wheat region in 1960. U. S. Department of Agriculture, Agricultural Research Service, Crops Research Division. CR-10-61, 77 pp. (Processed) January 1961.





## SOURCE OF THE SAMPLES

Samples were received from 17 stations of the states of Minnesota, North Dakota, South Dakota, and Washington durum wheat quality tests. The varieties Mindum, Langdon, Wells, and Lakota were grown in plots at Crookston, Rosemount, and Morris in Minnesota; Langdon, Minot, and Fargo in North Dakota; and Brookings, Watertown, and Highmore in South Dakota. In addition, the varieties Sentry, Ramsey, Ld 408, as well as some new strains were grown at Langdon, North Dakota. Sentry, Ramsey, Yuma, and Ld 408 were grown in South Dakota as well as some new strains.

Approximately 360 small samples (150 grams) were tested representing new and old varieties from stations in 4 states. Of these samples, 62 were "dwarf" durums and 78 were new and old varieties which were grown at Langdon, North Dakota. Approximately 16 varieties were grown at each of the Minnesota stations of St. Paul, Crookston, and Morris. These same varieties were also grown at each of the South Dakota stations of Brookings, Watertown, Highmore, and Eureka. One hundred and seven samples were received from the state of Washington for testing. Of these, 15 varieties and new strains were from Pullman. The varieties Sentry, Lakota, and Wells, all from the stations Dusty, Pomeroy, and Walla Walla, were each grown at two levels of fertility. The 49 samples from Lind were grown at one fertility level.

Six commercial composite samples from carlot receipts of durum wheat sampled over a 90-day period at two of the field offices (Duluth, and Minneapolis, Minnesota) of the Grain Division, AMS, were tested and processed into tubular macaroni. The results are included in this report for comparisons with the experimentally grown durum.

## METHODS

The methods used in the testing were essentially the same as in last year's report, but because of circumstances, some changes were made.

Briefly discussed, the following methods and terminology were applied:

Test Weight per Bushel - the weight per Winchester bushel of dockage-free wheat.

Milling - The plot samples were milled and tested at Fargo by the Department of Cereal Technology, NDSU. The dockage-free wheat was tempered in two stages; first to 13.5% for 18 hours, then to 15.5% one hour before milling. The method is essentially the same as described by Harris and Sibbitt. 4/

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4/ Harris, R. H., and Sibbitt, L. D. Experimental Durum Milling and Processing Equipment, with Further Quality Studies on North Dakota Durum Wheats. Cereal Chemistry 19:388-402. 1942.





The nursery samples were milled and tested at Beltsville. The dockage-free wheat was tempered in two stages: 15% moisture for 72 hours and the 2nd temper to 17 percent, 1 hour previous to milling on the Allis-Chalmers 5/ laboratory mill. Semolina was prepared with the aid of a small scale purifier.

Protein content is calculated by multiplying by the factor 5.7 the percent nitrogen as determined by the standard Kjeldahl procedure.

Values are reported on a 14% moisture basis.

Ash content is the residue of minerals left after incinerating a sample for approximately 16 hours at 600° C. The results are reported as percentage, on a 14% moisture basis.

Absorption is the water, expressed as a percent of the semolina, required to bring the dough to the proper consistency.

Carotenoid pigments are measured with a spectrophotometer at 440 mμ as color intensity of water-saturated N-butanol extract of ground wheat or semolina. The concentration of pigment is calculated by the formula:

$$C = \frac{(-\log_{10} T)}{b K} \quad \text{where } C = \text{parts per million (P.P.M.) carotene,} \\ T = \text{transmittance, and} \\ K = 1.6632 \text{ 6/}.$$

The Color Score. The color of the macaroni or semolina is generally accepted as the most important single grading factor. A deep amber or golden color is the most preferable. The amount of yellow pigmentation determines the extent or degree of amberiness. Because of the transfer of the Spring and Durum Wheat Quality Laboratory to North Dakota State University at Fargo, North Dakota, from Beltsville, Maryland, it has been necessary to change the grading system. The following grading system has been adopted for scoring the color of macaroni and semolina:

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5/ Mention of a trade product, equipment, or a commercial company in this publication does not imply its endorsement by the United States Department of Agriculture over similar products or companies not named.

6/ American Association of Cereal Chemists, Inc. Cereal Laboratory Methods, 6th Ed., St. Paul, Minnesota. 528 pp. 1957.





| <u>Color Score 7/</u> | <u>Description</u>  |
|-----------------------|---|
| 12 -                  | Much deeper and intense yellow pigmentation than standard.  |
| 11 -                  | Deeper and more intense yellow pigmentation than standard.  |
| 10 -                  | Standard quantity, depth and intensity of yellow pigmentation.  |
| 9 -                   | Slightly less depth and intensity but sufficient quantity of pigmentation.  |
| 8 -                   | Slightly less quantity as well as depth and intensity of pigmentation than the standard, but still sufficient to be rated satisfactory on the basis of color. |
| 7 -                   | Sufficiently less quantity of yellow pigmentation than the standard to give a pale yellow color and graded unsatisfactory for color score.                    |
| 6 -                   | Sufficiently less quantity of yellow pigmentation than the standard to give a very pale yellow color.   |
| 5 -                   | Only a sufficient quantity of yellow pigmentation to indicate an off-white color with a yellow hue.   |

There are three changes with this grading system over the one which has been used in the past:

1. The numerical rating describes the depth or amount of pigmentation, thus deleting the necessity for a visual appearance column.
2. The numerical rating number is reversed, that is, a 10 under the new scoring system is equivalent to a 1 by the former system: a 9 equals a 2, an 8 equals a 3, etc.
3. In cases where a sample is graded down because of off-color, speckiness, etc., the designation is shown by a letter abbreviation following the numerical score. For example; a 4 W would indicate the sample was chalky white with little or no yellow pigmentation, a 6 D would indicate the sample had some yellow pigmentation, but was dull.

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7/ Samples which have a color rating below 8 are unsatisfactory. It is possible that the average color score for a crop year may be higher or lower than average, therefore, this would be a sample taken into consideration when giving the overall rating of a variety for that given year. A sample may receive a low rating for reasons other than a deficiency of yellow pigmentation such as dullness, D; greyiness, G; redness, R; brownness, B; chalkiness or white cast, W; and speckiness, S; or a combination of these factors. The sample will be rated accordingly with the exception of the intensity, quantity, and depth of the yellow pigmentation.





Lipoxidase is the enzyme responsible for the destruction of the carotenoid (yellow) pigments during the manufacture of the macaroni. Some destruction of color is inevitable, but there is evidence that excessive concentrations of the enzyme may reduce the amounts of yellow pigments so that the color characteristics of the finished product are unsatisfactory.

The method<sup>8</sup> used for the estimation of lipoxidase is essentially that developed by Irvine and Anderson. <sup>8/</sup> The results are reported as microliters of oxygen taken up per minute per gram of sample.

Mixogram, farinogram. The mixograph has been used when the sample was too small for the farinograph. Either instrument yields a graphic record of the progressive changes in dough characteristics during the mixing process. A descriptive term relative to strength has been used to describe the curve rather than numerical values.

Sedimentation values - not determined.

Gluten - no tests were made.

Macaroni - Six hundred grams of semolina are mixed with water to form a stiff dough which is then pressed into macaroni and dried. The equipment and procedure have been described by Sibbitt and Harris <sup>4/</sup> and by Fifield. <sup>9/</sup>

Disk Test - The disk test <sup>10/</sup> follows generally the procedure used in making macaroni. The test is appropriate for use when only small quantities of wheat are available.

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<sup>4/</sup> Harris and Sibbitt, loc. cit.

<sup>8/</sup> Irvine, G.N., and Anderson, J.A. Variations in principal quality factors of durum wheats with a quality prediction test for wheat or semolina. Cereal Chemistry 30:334-342. 1953.

<sup>9/</sup> Fifield, C. C. Experimental equipment for the manufacture of alimentary pastes. Cereal Chemistry 11:330-334. 1934.

<sup>10/</sup> Fifield, C. C., Smith, Glenn S., and Hayes, J. F. Quality in durum wheats and a method for testing small samples. Cereal Chemistry 14:661-673. 1937.



Cooking Test - The method originally developed by Borasio 11/ and modified by Binnington, Johannson, and Geddes 12/ was used in the present work essentially as described by Harris and Knowles. 13/ Twenty-five grams of dried macaroni were placed in 250 ml of water (95.5°C) contained in a tall form 500 ml beaker, maintained at this temperature in a constant temperature bath held at 101° C. The sample was cooked for 30 minutes with two gentle stirrings during the period. It was then drained in a Büchner funnel and thoroughly rinsed with distilled water. Cooking water and rinse were evaporated to dryness. Weight of the residue was calculated and reported as a percentage of the dry sample. The cooked weight of macaroni was also reported. Tenderness of firmness was reported as the weight of mercury required to crush a strand of the macaroni. The value reported is the average of five determinations.

#### EXPERIMENTAL RESULTS

The results obtained are tabulated and presented in the following order: Tables 1, 2, and 3, plot experiments by states; Tables 4 to 10, inclusive, nursery samples; Table 11, commercial durum samples. Averages by state are presented wherever such values appear to be useful.

#### STATION PLOT EXPERIMENTS

Minnesota - (Table 1) The four varieties of Mindum, Langdon, Wells, and Lakota were submitted for testing. All produced macaroni of excellent quality. Mindum had the highest test weight for all three stations. Lakota had the lowest average test weight and was below 60 at the Rosemount station. Lakota and Wells were highest in protein, but all samples were above 14% except Mindum and Langdon at Crookston, which was in line with the test weights. Mindum and Langdon produced the best yields of purified semolina.

North Dakota - All test weights were well above 60; especially high were those of Mindum, Sentry, Ramsey, and Langdon at Fargo. But proteins at Fargo were abnormally low and macaroni color scores (quality) were less than satisfactory. (The entire crop was, on the average, minimal in color rating for the samples tested.) Semolina protein at Langdon ranged from 14.0% to 15.7%, averaging 14.5%, and even high at Minot, averaging 15.3%. Of the named varieties from Langdon, only Sentry produced macaroni of satisfactory quality, while of the selections, only 56-45 yielded macaroni rated lower than 8. The macaroni obtained from all the varieties from Minot was rated satisfactory to excellent with the exceptions of Mindum and Ramsey.

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11/ Borasio, L., Le caratteristiche di cottura della pasta ed. i metodi di ricerca. Giorn. di Riscicoltura 25: 251-257. 1935.

12/ Binnington, D. S., Johannson, H., and Geddes, W. F. Quantitative methods for evaluating the quality of macaroni products. Cereal Chemistry 16:149-167. 1939.

13/ Harris, R. H., and Knowles, Darline. Macaroni cooking value of some North Dakota durum wheat samples. Food Research 8:292-298. 1943.





South Dakota - The varieties Ramsey, Langdon, Wells, Lakota, Yuma, and Ld 408 were grown at the stations of Watertown, Highmore, and Brookings. The samples supplied for the stations of Watertown and Highmore were small and accordingly were composited by variety for testing. RL 3394 and 9 new selections are included in the composites.

#### NEW VARIETIES GROWN IN STATION NURSERIES

In the early generations of new varieties, it is important to get all possible information concerning the quality characteristics of the new varieties. To this end, some of the quality tests which require only small amounts of sample have been applied to 365 small samples of varieties grown in the station nurseries of North Dakota, Minnesota, South Dakota, and Washington. In North Dakota, 62 new varieties (and older varieties as checks) classified as "dwarf" durums were grown at Langdon. Also at Langdon, 78 other varieties were grown in single-row nurseries. In 7 stations of Minnesota and South Dakota, 16 varieties new and old were grown uniformly. Thirteen of these varieties, together with 36 others, were also grown at Lind, Washington. Twenty-one varieties were grown at Pullman in fertilization trials.

#### North Dakota

In the "dwarf" durum group (see Table 4) no sample was rated by color score as "good" or "excellent" (10). Only two of the new varieties and five of the six check samples were rated 9 (satisfactory). The relatively low rating of the checks indicates that seasonal conditions were responsible, in part, for the poor showing. Most of the samples had a fairly adequate content of carotenoid pigment. (Range 3.9 to 7.2, p.p.m. averaging 5.3 p.p.m.) The relatively high content of lipoxidase may contribute to the inferiority of the macaroni as judged by color. The protein content of these samples is reasonably high, ranging from 14.1 to 16.3%, averaging 15.0%.

Of the 78 varieties in the single-row nurseries (see Table 5) only 5, including two of the checks, were rated as high as 9 in the macaroni color score. Twenty-nine, including two more checks, were rated 8. The remainder (44) were thus rated 7 or less, normally considered unsatisfactory. Since the checks (normally good to excellent) were rated down, perhaps the varieties rated 7 (30 in number) should be rated as "doubtful." These varieties might show good or excellent in a favorable season. Protein content and carotenoid pigments both are generally high. Lipoxidase content is about normal with few exceptions.

#### Minnesota

The results for this group are given in Table 6, together with the averages by variety for the 3 stations. These samples made generally satisfactory macaroni. The ratings were generally higher for the samples grown at St. Paul than for the others as shown by the averages: St. Paul - 8.8; Crookston - 7.8; and Morris - 7.8. Carotenoid content is generally adequate at all stations. Lipoxidase content averaged about 20 units, which is about normal. The relationship between lipoxidase, carotenoid, and color score is not very apparent, but the following averages may have some significance:





|                    | <u>St. Paul</u> | <u>Crookston</u> | <u>Morris</u> |
|--------------------|-----------------|------------------|---------------|
| Lipoxidase, units  | 17              | 23               | 21            |
| Color Score        | 8.8             | 7.8              | 7.8           |
| Carotenoid, p.p.m. | 8.4             | 8.1              | 7.1           |

The protein content, on the average, is about 10% lower in the St. Paul samples than in the others.

#### South Dakota

In Table 7 are shown the results of tests performed on samples grown in four stations of South Dakota. These included the varieties grown in Minnesota and the variety Yuma. Sentry also was grown at Brookings and Watertown.

Of the 70 samples received from the stations of South Dakota, all but 13 yielded macaroni which was rated "satisfactory." Six of the 13 were grown at Brookings, 5 at Eureka, and 2 at Highmore. Accordingly, the samples from Watertown had the highest average color score and carotenoid content. The protein content was generally high, especially for the Highmore and Eureka samples, while the lowest protein occurred in the Brookings samples.

On the basis of average color scores, the best macaroni was produced from Lakota and Ld 408. Four of the new varieties were nearly as good, while Mindum and Yuma were rated poorest. Here, as in North Dakota, the results appear to reflect the adverse seasonal conditions.

#### Washington

Of the 107 samples received from Washington stations, (see Tables 8 and 9) only one was rated less than 8 on the color scale, while all but 11 were rated 9 or 10. The average of the color scores of the 49 samples grown at Lind was 9.2, while the carotenoid pigment content (average 7.0 p.p.m.) and the protein content (average 16.2%) were well above the minimum satisfactory level.

The varieties received from Pullman, Dustry, Pomeroy, and Walla Walla were grown at each of two fertility levels. All samples were of satisfactory quality, with adequate carotenoid pigment and protein content. As might be expected, the average protein content was slightly higher for the durumms receiving additional fertilizer.

#### COMPARISON OF THE COLOR SCORES

In Table 10 are shown the ratings for each of 15 varieties grown at 8 stations of Minnesota, South Dakota, and Washington - listed in descending order. In view of the adverse seasonal conditions at many of the stations, the comparisons are perhaps not as meaningful as in years past. It is interesting to note that Mindum, long regarded as one of the best varieties, appears at the bottom of this list.



#### COMMERCIAL SAMPLES

Six samples of commercially grown durum wheat were obtained through the Grain Division, Agricultural Marketing Service. These represented 5 grades and were composited by grade from 401 carlots of wheat received at Minneapolis and Duluth. Results of the tests performed on these samples are shown in Table 11. The samples are quite uniform in composition and quality. Only one had a protein content less than 14.5% (3 AD, 12.7%). This one also rated lowest in firmness value for the macaroni. In color characteristics of macaroni, all rated somewhat less than satisfactory (8), in line with observations for the nursery samples for the 1961 crop.





Table 1. Quality Data of Durum Wheat varieties Grown in Plots, 1961 Crop

Minnesota

| Variety<br>or<br>Cross | Test<br>Weight<br>lbs/bu. | Unofficial<br>Grade | Approx.<br>Vit.<br>Kernels<br>Pct. | Kernel <sup>1/</sup><br>Damage | 1000<br>Kernel<br>Weight<br>g. | Protein <sup>2/</sup> |                  | Semolina<br>Yield  |                  | Ash<br><sup>2/</sup><br>Pct. | Semolina<br>Specks<br>Per 10 sq.in. | Ab-<br>sorp-<br>tion<br>Pct. | Visual<br>Macaroni<br>Color Score <sup>3/</sup> | Farinogram<br>Type <sup>4/</sup> |
|------------------------|---------------------------|---------------------|------------------------------------|--------------------------------|--------------------------------|-----------------------|------------------|--------------------|------------------|------------------------------|-------------------------------------|------------------------------|---|----------------------------------|
|                        |                           |                     |                                    |                                |                                | Wheat<br>Pct.         | Semolina<br>Pct. | Unpurified<br>Pct. | Purified<br>Pct. |                              |                                     |                              |   |                                  |
| Crockston              |                           |                     |                                    |                                |                                |                       |                  |                    |                  |                              |                                     |                              |   |                                  |
| Mindum                 | 64.2                      | 1 HAD               | 90                                 |                                | 35.8                           | 13.3                  | 12.1             | 69.9               | 59.8             | 0.43                         | 11                                  | 33.3                         | 10.0  | Medium                           |
| Langdon                | 63.0                      | 1 HAD               | 90                                 |                                | 33.0                           | 13.8                  | 12.4             | 70.3               | 60.0             | 0.46                         | 9                                   | 33.3                         | 9.5   | M.Weak                           |
| Wells                  | 62.2                      | 1 HAD               | 90                                 |                                | 31.5                           | 14.8                  | 13.5             | 68.2               | 56.3             | 0.48                         | 5                                   | 33.3                         | 10.0  | Medium                           |
| Lakota                 | 61.2                      | 1 HAD               | 90                                 | Tr.B.P.                        | 32.2                           | 15.1                  | 13.3             | 69.6               | 56.3             | 0.50                         | 6                                   | 33.3                         | 10.0  | M.Strong                         |
| Rosemount              |                           |                     |                                    |                                |                                |                       |                  |                    |                  |                              |                                     |                              |   |                                  |
| Mindum                 | 61.4                      | 1 HAD               | 90                                 |                                | 37.1                           | 14.7                  | 13.5             | 69.6               | 56.6             | 0.61                         | 7                                   | 32.0                         | 10.0  | Medium                           |
| Langdon                | 61.1                      | 1 HAD               | 90                                 |                                | 37.3                           | 15.0                  | 13.9             | 72.2               | 58.7             | 0.61                         | 5                                   | 32.3                         | 9.5   | Medium                           |
| Wells                  | 60.5                      | 1 HAD               | 90                                 |                                | 33.4                           | 16.0                  | 14.7             | 68.4               | 56.1             | 0.67                         | 8                                   | 32.0                         | 10.0  | M.Weak                           |
| Lakota                 | 59.7                      | 2 HAD               | 90                                 | Tr.G.K.                        | 34.4                           | 15.8                  | 14.4             | 70.2               | 57.3             | 0.66                         | 7                                   | 32.0                         | 10.0  | Medium                           |
| Morris                 |                           |                     |                                    |                                |                                |                       |                  |                    |                  |                              |                                     |                              |   |                                  |
| Mindum                 | 64.8                      | 1 HAD               | 95                                 |                                | 40.5                           | 14.3                  | 12.8             | 71.6               | 60.2             | 0.57                         | 5                                   | 32.0                         | 9.5   | M.Strong                         |
| Langdon                | 63.3                      | 1 HAD               | 90                                 | Bl.                            | 38.3                           | 14.2                  | 12.8             | 70.6               | 60.0             | 0.56                         | 5                                   | 32.0                         | 9.5   | Medium                           |
| Wells                  | 63.1                      | 1 HAD               | 90                                 | Tr.B.P.                        | 34.6                           | 15.0                  | 13.7             | 70.8               | 58.7             | 0.60                         | 6                                   | 32.3                         | 9.5   | M.Weak                           |
| Lakota                 | 62.0                      | 1 HAD               | 95                                 |                                | 33.5                           | 14.8                  | 13.4             | 69.5               | 58.2             | 0.56                         | 9                                   | 32.3                         | 9.5   | M.Strong                         |
| Average, 3 stations    |                           |                     |                                    |                                |                                |                       |                  |                    |                  |                              |                                     |                              |   |                                  |
| Mindum                 | 63.5                      |                     | 92                                 |                                | 37.8                           | 14.8                  | 12.8             | 70.4               | 58.8             | 0.54                         | 8                                   | 32.8                         | 9.7   | Medium +                         |
| Langdon                | 62.5                      |                     | 90                                 |                                | 36.3                           | 14.3                  | 13.0             | 71.1               | 59.6             | 0.54                         | 6                                   | 32.5                         | 9.5   | Medium -                         |
| Wells                  | 61.9                      |                     | 90                                 |                                | 33.2                           | 15.3                  | 14.0             | 69.1               | 57.0             | 0.58                         | 6                                   | 32.5                         | 9.7   | Weak +                           |
| Lakota                 | 61.0                      |                     | 92                                 |                                | 33.7                           | 15.2                  | 13.7             | 69.8               | 57.3             | 0.57                         | 7                                   | 32.5                         | 9.7   | M.Strong-                        |

1/ Tr. = trace; B.P. = black point; G.K. = green kernels; Bl = blanched.

2/ Reported on 14.0% moisture basis.

3/ Satisfactory score - 10.0 Unsatisfactory - less than 8.0

4/ 7 gradations: Very strong- 8; strong, 7; medium-strong- 6; medium- 5; medium-weak- 4; weak- 3; very weak- 2.



Table 2. Quality Data of Durum Wheat Varieties Grown in Plots, 1961 Crop

| Variety<br>or<br>Cross | Test<br>Weight<br>lbs/bu. | Unofficial<br>Grade | Approx.<br>Vit.<br>Kernels<br>Pct. | Kernel <sup>1/</sup><br>Damage | 1000<br>Kernel<br>Weight<br>g. | Protein <sup>2/</sup> |                  | Semolina<br>Yield  |                  | Ash<br>2/<br>Pct. | Semolina<br>Specks<br>Per 10 sq.in. | Ab-<br>sorp-<br>tion | Visual<br>Macaroni<br>Color | Farinogram<br>Type<br>4/ |
|------------------------|---------------------------|---------------------|------------------------------------|--------------------------------|--------------------------------|-----------------------|------------------|--------------------|------------------|-------------------|-------------------------------------|----------------------|-----------------------------|--------------------------|
|                        |                           |                     |                                    |                                |                                | Wheat<br>Pct.         | Semolina<br>Pct. | Unpurified<br>Pct. | Purified<br>Pct. |                   |                                     |                      |                             |                          |
| Fargo                  |                           |                     |                                    |                                |                                |                       |                  |                    |                  |                   |                                     |                      |                             |                          |
| Mindum                 | 65.4                      | 1 HAD               | 95                                 | 6.0%SK                         | 39.9                           | 12.4                  | 11.4             | 70.0               | 60.5             | 0.59              | 10                                  | 32.7                 | 7.0                         | Medium                   |
| Sentry                 | 65.2                      | 1 HAD               | 95                                 | 2.0%SK                         | 42.8                           | 12.2                  | 11.5             | 74.5               | 61.8             | 0.58              | 14                                  | 32.0                 | 7.0                         | Weak                     |
| Ramsey                 | 65.1                      | 1 HAD               | 95                                 | 2.5%SK                         | 40.2                           | 12.2                  | 11.3             | 72.9               | 61.2             | 0.58              | 7                                   | 32.0                 | 7.0                         | Medium                   |
| Langdon                | 65.2                      | 1 HAD               | 85                                 | 11.5%SK                        | 43.3                           | 11.6                  | 10.6             | 72.4               | 60.4             | 0.58              | 10                                  | 33.0                 | 7.0                         | Medium                   |
| Wells                  | 64.5                      | 1 HAD               | 85                                 | 15.0%SK                        | 36.2                           | 11.0                  | 10.2             | 67.9               | 56.6             | 0.57              | 7                                   | 32.3                 | 7.0                         | M.Weak                   |
| Lakota                 | 63.1                      | 1 HAD               | 85                                 | 15.0%SK                        | 34.6                           | 11.0                  | 10.3             | 70.3               | 58.2             | 0.62              | 9                                   | 33.3                 | 6.0                         | M.Strong                 |
| Ld 408                 | 63.3                      | 1 HAD               | 90                                 | 6.0%SK                         | 31.8                           | 11.8                  | 11.3             | 65.7               | 57.2             | 0.57              | 11                                  | 32.7                 | 7.0                         | Medium                   |
| Langdon                |                           |                     |                                    |                                |                                |                       |                  |                    |                  |                   |                                     |                      |                             |                          |
| Mindum                 | 64.2                      | 1 HAD               | 90                                 |                                | 45.3                           | 15.5                  | 14.7             | 71.1               | 59.7             | 0.62              | 14                                  | 34.0                 | 7.0                         | M.Strong                 |
| Sentry                 | 62.4                      | 1 HAD               | 90                                 | B.P.                           | 39.2                           | 16.2                  | 15.0             | 65.0               | 54.9             | 0.64              | 18                                  | 33.7                 | 9.0                         | V.Weak                   |
| Ramsey                 | 63.5                      | 1 HAD               | 90                                 | Tr.B.P.                        | 42.0                           | 15.0                  | 14.0             | 72.0               | 60.3             | 0.62              | 12                                  | 33.7                 | 7.0                         | Medium                   |
| Langdon                | 62.0                      | 1 HAD               | 90                                 |                                | 42.0                           | 15.5                  | 14.4             | 69.3               | 57.6             | 0.61              | 17                                  | 33.3                 | 5.5                         | M.Weak                   |
| Wells                  | 63.4                      | 1 HAD               | 90                                 |                                | 37.7                           | 15.6                  | 14.7             | 71.6               | 59.9             | 0.67              | 18                                  | 33.3                 | 7.0                         | M.Weak                   |
| Lakota                 | 62.7                      | 1 HAD               | 90                                 | B.P.                           | 36.4                           | 16.0                  | 14.6             | 69.3               | 57.9             | 0.59              | 15                                  | 34.0                 | 7.0                         | M.Strong                 |
| Ld 408                 | 62.5                      | 1 HAD               | 90                                 |                                | 29.0                           | 16.4                  | 15.7             | 71.8               | 59.7             | 0.57              | 13q                                 | 33.3                 | 9.5                         | Medium                   |
| 56-1                   | 63.6                      | 1 HAD               | 90                                 |                                | 37.4                           | 14.9                  | 14.0             | 74.5               | 61.2             | 0.60              | 11                                  | 34.7                 | 9.0                         | Medium                   |
| 56-16                  | 63.5                      | 1 HAD               | 90                                 |                                | 36.1                           | 15.2                  | 14.5             | 72.3               | 59.8             | 0.61              | 13                                  | 34.3                 | 9.0                         | Medium                   |
| 56-17                  | 63.8                      | 1 HAD               | 90                                 |                                | 38.4                           | 14.8                  | 14.0             | 72.7               | 59.1             | 0.59              | 15                                  | 34.0                 | 9.0                         | Medium                   |
| 56-21                  | 63.5                      | 1 HAD               | 90                                 |                                | 38.5                           | 14.7                  | 14.3             | 73.4               | 59.9             | 0.57              | 12                                  | 34.0                 | 8.0                         | M.Strong                 |
| 56-45                  | 62.4                      | 1 HAD               | 90                                 |                                | 37.6                           | 15.1                  | 14.4             | 74.5               | 60.5             | 0.56              | 17                                  | 34.7                 | 6.5                         | Medium                   |
| Minot                  |                           |                     |                                    |                                |                                |                       |                  |                    |                  |                   |                                     |                      |                             |                          |
| Mindum                 | 62.7                      | 1 HAD               | 95                                 |                                | 28.9                           | 16.7                  | 15.9             | 69.2               | 57.2             | 0.52              | 5                                   | 33.7                 | 7.0                         | M.Strong                 |
| Ramsey                 | 62.6                      | 1 HAD               | 95                                 |                                | 32.8                           | 16.1                  | 15.8             | 69.6               | 58.5             | 0.55              | 3                                   | 34.0                 | 7.0                         | Medium                   |
| Langdon                | 62.1                      | 1 HAD               | 95                                 |                                | 27.7                           | 16.4                  | 15.2             | 70.5               | 58.1             | 0.51              | 4                                   | 33.7                 | 8.0                         | Medium                   |
| Wells                  | 61.8                      | 1 HAD               | 95                                 |                                | 26.6                           | 16.8                  | 15.3             | 61.6               | 51.5             | 0.49              | 5                                   | 33.3                 | 9.0                         | M.Weak                   |
| Lakota                 | 60.6                      | 1 HAD               | 95                                 |                                | 27.5                           | 16.9                  | 16.1             | 63.9               | 53.4             | 0.51              | 7                                   | 33.7                 | 10.0                        | M.Strong                 |
| Ld 408                 | 60.7                      | 1 HAD               | 90                                 |                                | 23.3                           | 17.3                  | 16.6             | 69.1               | 57.7             | 0.49              | 3                                   | 33.7                 | 10.0                        | Medium                   |
| Madsen                 | 62.7                      | 1 HAD               | 95                                 |                                | 29.8                           | 18.4                  | 14.7             | 69.1               | 56.9             | 0.51              | 4                                   | 33.7                 | 8.0                         | M.Weak                   |
| 56-16                  | 61.0                      | 1 HAD               | 95                                 |                                | 25.0                           | 16.4                  | 15.0             | 60.7               | 50.7             | 0.50              | 5                                   | 34.3                 | 9.5                         | M.Strong                 |
| 56-17                  | 61.7                      | 1 HAD               | 95                                 |                                | 26.0                           | 16.1                  | 14.5             | 66.5               | 53.7             | 0.46              | 4                                   | 33.7                 | 9.5                         | M.Strong                 |
| 56-21                  | 61.6                      | 1 HAD               | 95                                 |                                | 25.7                           | 16.0                  | 14.7             | 65.2               | 55.2             | 0.48              | 6                                   | 34.7                 | 8.0                         | Medium                   |
| 56-45                  | 61.0                      | 1 HAD               | 95                                 |                                | 27.0                           | 16.2                  | 14.9             | 68.2               | 57.0             | 0.47              | 6                                   | 33.7                 | 9.5                         | M.Strong                 |
| Averages - 3 stations  |                           |                     |                                    |                                |                                |                       |                  |                    |                  |                   |                                     |                      |                             |                          |
| Mindum                 | 64.1                      | 1 HAD               | 93                                 |                                | 38.0                           | 14.9                  | 14.3             | 70.4               | 59.1             | 0.58              | 10                                  | 33.5                 | 7.0                         | M.Strong                 |
| Ramsey                 | 63.7                      | 1 HAD               | 93                                 |                                | 38.3                           | 14.4                  | 13.7             | 71.5               | 56.7             | 0.68              | 7                                   | 33.2                 | 7.0                         | Medium                   |
| Langdon                | 63.1                      | 1 HAD               | 90                                 |                                | 37.7                           | 14.5                  | 13.4             | 70.6               | 58.7             | 0.57              | 10                                  | 33.3                 | 6.8                         | Medium -                 |
| Wells                  | 63.2                      | 1 HAD               | 90                                 |                                | 33.2                           | 14.5                  | 13.7             | 67.0               | 56.0             | 0.58              | 10                                  | 33.0                 | 7.7                         | M.Weak                   |
| Lakota                 | 62.1                      | 1 HAD               | 90                                 |                                | 32.8                           | 14.6                  | 13.7             | 67.8               | 56.5             | 0.57              | 10                                  | 33.7                 | 7.7                         | M.Strong                 |
| Ld 408                 | 62.2                      | 1 HAD               | 90                                 |                                | 28.0                           | 15.2                  | 14.5             | 63.9               | 58.2             | 0.54              | 9                                   | 33.2                 | 8.8                         | Medium                   |

1/ T = Trace; B.P. = black point; G.K. = green kernels; Bl = blanched.

2/ Reported on 14.0% moisture basis.

3/ Satisfactory score - 10.0; unsatisfactory - less than 8.0

4/ 7 gradations: Very strong- 8; Strong- 7; Medium strong- 6; Medium- 5; Medium weak- 4; Weak- 3; Very weak- 2.





Table 3. Quality Data of Durum Wheat Varieties Grown  
in Plots, 1961 Crop

| Variety<br>or<br>Cross         | Test<br>Weight<br>lbs./bu. | Kernel<br>Appear-<br>ance <sup>1/</sup> | 1000<br>Kernel<br>Weight<br>g. | Wheat<br>Protein <sup>2/</sup><br>% | Semolina Yield               |               | Semolina<br>Specks per<br>10 sq. in. | Absorp-<br>tion<br>% | Visual<br>Macaroni<br>Color Score <sup>3/</sup> | Mixogram<br>Type <sup>4/</sup> |
|--------------------------------|----------------------------|---|--------------------------------|-------------------------------------|------------------------------|---------------|--------------------------------------|----------------------|---|--------------------------------|
|                                |                            |   |                                |                                     | Unpurified<br>%              | Purified<br>% |                                      |                      |   |                                |
|                                |                            |   |                                |                                     | Watertown Highmore Composite |               |                                      |                      |   |                                |
| Ramsey                         | 62.0                       | A                                       | 36.1                           | 17.8 <sup>5/</sup>                  | 75.4                         | 65.2          | 20                                   | 32.7                 | 8.5   | M.Weak                         |
| Langdon                        | 60.0                       | A                                       | 32.3                           | 17.9                                | 75.4                         | 64.2          | 17                                   | 32.7                 | 9.5   | Medium                         |
| Wells                          | 61.0                       | H                                       | 32.2                           | 18.1                                | 74.1                         | 63.1          | 17                                   | 32.7                 | 9.5   | Medium                         |
| Lakota                         | 59.0                       | A                                       | 30.0                           | 18.1                                | 72.8                         | 63.3          | 17                                   | 33.7                 | 9.5   | Strong                         |
| Mindum                         | 63.0                       | A                                       | 33.9                           | 17.2                                | 75.0                         | 64.5          | 20                                   | 34.3                 | 8.0   | M.Strong                       |
| Yuma                           | 60.0                       | A                                       | 32.4                           | 17.7                                | 75.0                         | 64.2          | 23                                   | 34.3                 | 6.5   | Strong                         |
| Ld 408                         | 59.0                       | H                                       | 28.5                           | 17.3                                | 73.7                         | 63.7          | 17                                   | 34.3                 | 9.5   | M.Strong                       |
| 56-45                          | 61.0                       | A                                       | 37.1                           | 16.6                                | 75.1                         | 66.3          | 20                                   | 33.7                 | 9.5   | M.Strong                       |
| 56-62                          | 61.0                       | A                                       | 34.2                           | 17.3                                | 74.4                         | 65.8          | 17                                   | 33.3                 | 8.5   | M.Strong                       |
| 56-16                          | 61.0                       | A                                       | 33.6                           | 17.3                                | 78.8                         | 67.4          | 27                                   | 34.0                 | 9.5   | M.Strong                       |
| 56-21                          | 62.0                       | A                                       | 31.4                           | 17.0                                | 79.4                         | 68.6          | 37                                   | 34.0                 | 8.5   | M.Strong                       |
| 56-17                          | 61.0                       | A                                       | 34.0                           | 17.4                                | 77.0                         | 67.2          | 20                                   | 34.3                 | 9.0   | M.Strong                       |
| 56-50                          | 62.5                       | H                                       | 36.6                           | 16.5                                | 77.6                         | 64.6          | 27                                   | 34.3                 | 9.0   | Medium                         |
| 58-25                          | 61.0                       | H                                       | 35.9                           | 16.9                                | 77.0                         | 67.7          | 17                                   | 34.0                 | 10.0  | M.Strong                       |
| RL 3394                        | 61.0                       | H                                       | 35.0                           | 17.7                                | 77.4                         | 67.9          | 20                                   | 34.0                 | 10.0  | M.Strong                       |
| 58-62                          | 61.0                       | A                                       | 36.2                           | 17.3                                | 75.9                         | 67.1          | 10                                   | 34.0                 | 10.0  | Strong                         |
| 56-1                           | 61.0                       | A                                       | 33.7                           | 17.6                                | 76.0                         | 67.3          | 17                                   | 34.0                 | 10.0  | Medium                         |
| Watertown                      |                            |   |                                |                                     |                              |               |                                      |                      |   |                                |
| Sentry                         | 63.0                       | A                                       | 37.2                           | 16.1                                | 75.4                         | 67.1          | 20                                   | 33.3                 | 10.0  | Weak                           |
| Brookings                      |                            |   |                                |                                     |                              |               |                                      |                      |   |                                |
| Langdon                        | 63.0                       | D                                       | 40.9                           | 13.5                                | 78.9                         | 69.2          | 30                                   | 34.7                 | 6.5   | Medium                         |
| Ramsey                         | 63.0                       | D-B                                     | 41.3                           | 13.5                                | 78.0                         | 68.2          | 37                                   | 34.7                 | 5.5   | M.Weak                         |
| Wells                          | 62.0                       | D                                       | 37.7                           | 13.6                                | 75.8                         | 66.5          | 33                                   | 34.7                 | 6.5   | M.Strong                       |
| Lakota                         | 61.0                       | D                                       | 36.6                           | 13.5                                | 77.6                         | 68.2          | 30                                   | 35.0                 | 5.5   | Strong                         |
| LD 408                         | 61.0                       | S                                       | 29.9                           | 13.2                                | 75.2                         | 66.7          | 30                                   | 34.7                 | 8.0   | M.Strong                       |
| Sentry                         | 63.0                       | D-F                                     | 42.9                           | 14.7                                | 79.8                         | 70.9          | 37                                   | 34.3                 | 6.5   | Medium                         |
| Yuma                           | 62.0                       | D                                       | 39.8                           | 14.1                                | 78.8                         | 68.9          | 30                                   | 35.7                 | 5.5   | V.Strong                       |
| Weighted Averages - 3 stations |                            |   |                                |                                     |                              |               |                                      |                      |   |                                |
| Ramsey                         | 62.3                       |   | 37.8                           | 16.0                                | 76.3                         | 66.2          | 26                                   | 33.4                 | 7.5   | M.Weak                         |
| Langdon                        | 61.0                       |   | 35.2                           | 16.4                                | 76.6                         | 65.9          | 21                                   | 33.4                 | 8.2   | Medium                         |
| Wells                          | 61.3                       |   | 34.0                           | 16.7                                | 73.7                         | 64.3          | 22                                   | 33.4                 | 8.5   | Medium +                       |
| Lakota                         | 59.7                       |   | 32.2                           | 16.6                                | 74.4                         | 64.9          | 21                                   | 34.2                 | 8.2   | Strong                         |
| Yuma                           | 60.7                       |   | 34.9                           | 16.5                                | 76.3                         | 65.8          | 25                                   | 34.8                 | 6.2   | Strong +                       |
| Ld 408                         | 59.7                       |   | 29.0                           | 15.9                                | 74.2                         | 64.7          | 21                                   | 34.4                 | 9.0   | M.Strong                       |



Table 4. Quality Data of Durum Varieties Grown in Nurseries, 1961 Crop

Dwarf Durum, Langdon, North Dakota

| Variety or Cross                                  | Sel. No. | Numerical Rating<br>1/ | Wheat Carotenoid Content<br>2/ 3/ |      | Protein Content<br>3/ | Semolina Lipoxidase<br>4/ |
|---|----------|------------------------|-----------------------------------|------|-----------------------|---------------------------|
|   |          |                        | P.p.m.                            | Pct. |                       | Units                     |
| Langdon   | 60-137   | 7                      | 6.0                               | 15.4 | -                     | -                         |
| (Willet Sib. x Norin-10-Brevor) x Ldn $F_4$ x Ldn | 60-137   | 7                      | 5.5                               | 14.2 | -                     | -                         |
| " "   | 60-140   | 5                      | 3.9                               | 14.7 | -                     | -                         |
| " "   | 60-142   | 6                      | 4.7                               | 14.8 | -                     | -                         |
| " "   | 60-143   | 5                      | 5.5                               | 14.8 | -                     | -                         |
| " "   | 60-146   | 7                      | 6.2                               | 15.4 | -                     | -                         |
| " "   | 60-148   | 5                      | 5.2                               | 14.7 | -                     | -                         |
| " "   | 60-155   | 5                      | 5.7                               | 15.0 | -                     | -                         |
| " "   | 60-157   | 5                      | 5.5                               | 14.7 | -                     | -                         |
| " "   | 60-161   | 5                      | 4.5                               | 15.5 | -                     | -                         |
| " "   | 60-162   | 5                      | 5.5                               | 14.8 | -                     | -                         |
| " "   | 60-163   | 7                      | 5.5                               | 15.0 | -                     | -                         |
| " "   | 60-165   | 5                      | 4.9                               | 14.9 | -                     | -                         |
| " "   | 60-167   | 5                      | 4.7                               | 15.5 | -                     | -                         |
| " "   | 60-168   | 5                      | 4.1                               | 15.8 | -                     | -                         |
| " "   | 60-169   | 5                      | 4.8                               | 15.7 | -                     | -                         |
| " "   | 60-170   | 5                      | 4.8                               | 15.0 | -                     | -                         |
| Wells   | 8        |                        | 7.0                               | 15.4 | -                     | -                         |
| (Willet Sib. x Norin-10-Brevor x Ldn $F_4$ x Ldn  | 60-172   | 7                      | 4.8                               | 15.7 | -                     | -                         |
| " "   | 60-173   | 7                      | 6.4                               | 15.1 | -                     | -                         |
| " "   | 60-174   | 6                      | 5.1                               | 15.6 | -                     | -                         |
| " "   | 60-175   | 5                      | 5.2                               | 15.4 | -                     | -                         |
| " "   | 60-177   | 7                      | 5.8                               | 14.7 | -                     | -                         |
| " "   | 60-177   | 6                      | 5.1                               | 14.8 | -                     | -                         |
| Lakota  | 60-177   | 8                      | 7.3                               | 16.0 | 28                    | 28                        |
| Willet Sib. x Norin-10-Brevor) x Ldn $F_4$ x Ldn  | 60-184   | 6                      | 5.8                               | 14.1 | 27                    | 27                        |
| " "   | 60-185   | 5                      | 5.6                               | 14.3 | 29                    | 29                        |
| " "   | 60-193   | 5                      | 5.2                               | 14.6 | 30                    | 30                        |
| " "   | 60-194   | 5                      | 6.2                               | 14.3 | 36                    | 36                        |
| " "   | 60-196   | 5                      | 5.4                               | 15.1 | 29                    | 29                        |
| " "   | 60-199   | 6                      | 4.7                               | 15.5 | 30                    | 30                        |
| " "   | 60-200   | 7                      | 5.7                               | 14.9 | 32                    | 32                        |
| " "   | 60-201   | 6                      | 5.9                               | 14.9 | 31                    | 31                        |
| " "   | 60-202   | 6                      | 5.1                               | 15.2 | 32                    | 32                        |
| " "   | 60-203   | 5                      | 5.3                               | 14.9 | 27                    | 27                        |
| " "   | 60-204   | 6                      | 5.2                               | 15.4 | 33                    | 33                        |
| " "   | 60-205   | 6                      | 5.5                               | 15.2 | 36                    | 36                        |
| " "   | 60-206   | 6                      | 4.9                               | 15.3 | 26                    | 26                        |
| " "   | 60-208   | 6                      | 4.9                               | 14.6 | 30                    | 30                        |
| " "   | 60-209   | 6                      | 4.6                               | 15.9 | 33                    | 33                        |
| " "   | 60-210   | 8                      | 5.9                               | 15.3 | 31                    | 31                        |
| " "   | 60-213   | 7                      | 5.6                               | 14.0 | 21                    | 21                        |
| " "   | 60-214   | 7                      | 5.9                               | 14.7 | 25                    | 25                        |
| Langdon   | 8        |                        | 6.5                               | 15.6 | 19                    | 19                        |
| (Willet Sib. x Norin-10-Brevor) x Ldn $F_4$ x Ldn | 60-217   | 7                      | 5.4                               | 14.6 | 34                    | 34                        |
| " "   | 60-218   | 6                      | 4.6                               | 15.2 | 33                    | 33                        |
| " "   | 60-221   | 6                      | 4.6                               | 16.1 | 33                    | 33                        |
| " "   | 60-222   | 6                      | 4.7                               | 14.4 | 37                    | 37                        |
| (Willet Sib. x Norin-10-Brevor) x Ldn $F_4$ x Ldn | 60-223   | 6                      | 4.7                               | 14.4 | 35                    | 35                        |
| " "   | 60-224   | 6                      | 5.1                               | 14.5 | 31                    | 31                        |
| " "   | 60-225   | 5                      | 4.9                               | 14.8 | 35                    | 35                        |
| Wells   | 8        |                        | 4.2                               | 15.1 | 19                    | 19                        |
| (Willet Sib. x Norin-10-Brevor) x Ldn $F_4$ x Ldn | 60-226   | 5                      | 3.9                               | 15.1 | 35                    | 35                        |
| " "   | 60-227   | 7                      | 4.7                               | 16.1 | 34                    | 34                        |
| " "   | 60-228   | 6                      | 4.6                               | 16.0 | 35                    | 35                        |
| " "   | 60-232   | 6                      | 5.7                               | 14.3 | 25                    | 25                        |
| Lakota  | 8        |                        | 7.0                               | 16.3 | 25                    | 25                        |
| (Willet Sib. x Norin-10-Brevor) x Ldn $F_4$ x Ldn | 60-237   | 7                      | 6.9                               | 14.8 | 28                    | 28                        |
| " "   | 60-239   | 8                      | 7.2                               | 15.1 | 26                    | 26                        |
| " "   | 60-240   | 6                      | 4.9                               | 15.3 | 26                    | 26                        |
| " "   | 60-241   | 5                      | 4.6                               | 14.2 | 23                    | 23                        |
| " "   | 60-244   | 5                      | 5.3                               | 14.2 | 20                    | 20                        |
| Average   |          | 6.2                    | 5.3                               | 15.0 |                       |                           |

1/ Rating based on color of macaroni product.

2/ Expressed as carotene p.p.m. water-saturated n-butyl alcohol extract.

3/ 14.0 percent moisture basis.

4/ Expressed in lipoxidase units - microliters of oxygen absorbed per minute per gram of samples.





Table 5. Quality Data of Durum Varieties Grown in  
Single-row Nursery  
Langdon, North Dakota  
1961 Crop

| Variety or Cross                        | Sel.<br>No. | Numeri-<br>cal<br>Rating<br><u>1/</u> | <u>Wheat</u><br>Carotenoid<br>Content<br><u>2/ 3/</u> |             | Protein<br>Content<br><u>3/</u> | Semolina<br>Lipoxidase<br><u>4/</u> |
|---|-------------|---------------------------------------|---|-------------|---------------------------------|-------------------------------------|
|   |             |                                       | <u>P.p.m.</u>   | <u>Pct.</u> |                                 | <u>Units</u>                        |
| Langdon                                 |             | 7                                     | 5.7   | 15.4        |                                 | 19                                  |
| Ld 368 x Pl 191076                      | 60-1        | 7                                     | 6.6   | 15.4        |                                 | 33                                  |
| Ld 157 - RL 1714 x Ld 357               | 60-8        | 7                                     | 6.6   | 15.9        |                                 | 14                                  |
| " "                                     | 60-10       | 7                                     | 7.2   | 15.5        |                                 | 14                                  |
| Wells                                   |             | 8                                     | 6.8   | 15.5        |                                 | 14                                  |
| Ld 357 - CI 7859                        | 60-4        | 8                                     | 7.4   | 15.0        |                                 | 15                                  |
| ST 464 x Langdon                        | 60-15       | 7                                     | 6.2   | 15.2        |                                 | 25                                  |
| Langdon x CI 8155                       | 60-18       | 8                                     | 7.1   | 14.4        |                                 | 21                                  |
| Lakota                                  |             | 8                                     | 7.4   | 15.3        |                                 | 21                                  |
| Langdon x CI 7780                       | 60-20       | 7                                     | 5.3   | 15.1        |                                 | 26                                  |
| " "                                     | 60-21       | 6                                     | 5.4   | 14.4        |                                 | 23                                  |
| Ramsey x Langdon                        | 60-23       | 7                                     | 6.3   | 14.6        |                                 | 25                                  |
| Ld 357 x (Sentry x Ld 379 - Ld 357)     | 60-25       | 7                                     | 6.9   | 15.0        |                                 | 21                                  |
| " "                                     | 60-26       | 7                                     | 6.5   | 15.2        |                                 | 22                                  |
| " "                                     | 60-29       | 8                                     | 6.7   | 15.2        |                                 | 23                                  |
| " "                                     | 60-30       | 8                                     | 6.9   | 14.8        |                                 | 22                                  |
| Ld 384 x Ld 368-22                      | 60-32       | 8                                     | 6.7   | 15.1        |                                 | 17                                  |
| " "                                     | 60-34       | 7                                     | 6.7   | 14.5        |                                 | 24                                  |
| Ld 385 x Ramsey                         | 60-38       | 7                                     | 7.7   | 14.8        |                                 | 21                                  |
| Ld 393 x Yuma                           | 60-44       | 7                                     | 6.9   | 15.3        |                                 | 25                                  |
| Lakota x St 464 x (Ld 340 x KDC - Car)  | 60-40       | 8                                     | 8.1   | 15.3        |                                 | 27                                  |
| " "                                     | 60-41       | 8                                     | 7.5   | 15.6        |                                 | 27                                  |
| " "                                     | 60-42       | 7                                     | 6.6   | 15.6        |                                 | 23                                  |
| Ld 397 x Ld 368 <sup>2</sup>            | 60-45       | 7                                     | 6.4   | 16.4        |                                 | 22                                  |
| Ld 398 x (Ld 357 <sup>2</sup> x St 464) | 60-47       | 6                                     | 5.8   | 16.4        |                                 | 23                                  |
| " "                                     | 60-50       | 6                                     | 5.9   | 15.2        |                                 | 29                                  |
| " "                                     | 60-52       | 6                                     | 6.2   | 15.0        |                                 | 26                                  |
| " "                                     | 60-53       | 6                                     | 6.1   | 15.0        |                                 | 25                                  |
| Ld 398 x (Ld 357 <sup>2</sup> x St 464) | 60-54       | 6                                     | 5.6   | 14.8        |                                 | 22                                  |
| Langdon x (Ld 357 x CI 7780 - Ld 352)   | 60-58       | 6                                     | 5.2   | 14.5        |                                 | 21                                  |
| " "                                     | 60-59       | 6                                     | 5.4   | 14.5        |                                 | 21                                  |
| " "                                     | 60-60       | 6                                     | 5.2   | 15.5        |                                 | 21                                  |
| " "                                     | 60-62       | 8                                     | 7.1   | 15.5        |                                 | 21                                  |
| Langdon x (Sentry x Ld 379 - Ld 357)    | 60-65       | 7                                     | 6.5   | 14.5        |                                 | 23                                  |
| " "                                     | 60-67       | 7                                     | 5.9   | 15.7        |                                 | 22                                  |
| " "                                     | 60-69       | 7                                     | 5.9   | 15.1        |                                 | 24                                  |
| Langdon x (Sentry x Ld 379 - Ld 357)    | 60-70       | 7                                     | 5.9   | 14.6        |                                 | 27                                  |
| Ld 382 x Langdon <sup>2</sup>           | 60-77       | 7                                     | 6.3   | 15.1        |                                 | 21                                  |
| " "                                     | 60-78       | 8                                     | 6.4   | 15.2        |                                 | 17                                  |
| " "                                     | 60-79       | 7                                     | 6.5   | 15.3        |                                 | 16                                  |
| " "                                     | 60-80       | 8                                     | 5.7   | 14.6        |                                 | 18                                  |
| " "                                     | 60-82       | 8                                     | 6.6   | 15.4        |                                 | 18                                  |
| " "                                     | 60-83       | 8                                     | 6.3   | 15.6        |                                 | 20                                  |
| Ld 393 x Yuma <sup>2</sup>              | 60-87       | 7                                     | 5.4   | 15.5        |                                 | 21                                  |
| " "                                     | 60-89       | 7                                     | 5.7   | 16.1        |                                 | 24                                  |
| Ld 393 x Langdon <sup>2</sup>           | 60-84       | 7                                     | 5.8   | 15.4        |                                 | 26                                  |
| " "                                     | 60-86       | 7                                     | 6.1   | 15.4        |                                 | 22                                  |
| CI 8133 x Langdon                       | 60-13       | 5                                     | 5.2   | 15.8        |                                 | 24                                  |
| St 464 x Langdon                        | 60-17       | 6                                     | 4.7   | 15.7        |                                 | 23                                  |
| Langdon                                 |             | 6                                     | 5.4   | 15.8        |                                 | 24                                  |

1/ Rating based on color of macaroni product.

2/ Expressed as carotene p.p.m. water-saturated n-butyl alcohol extracts.

3/ 14.0 percent moisture basis.

4/ Expressed in lipoxidase units - microliters of oxygen absorbed per minute per gram of samples.



Table 5. Quality Data of Durum Varieties Grown in  
Single-row Nurseries  
Langdon, North Dakota  
1961 Crop

Continued

| Variety or Cross                        | Sel.<br>No. | Numeri-<br>cal<br>Rating<br><u>1/</u> | Wheat                                 |                                 | Semolina<br>Lipoxidase<br><u>4/</u> |
|---|-------------|---------------------------------------|---------------------------------------|---------------------------------|-------------------------------------|
|   |             |                                       | Carotenoid<br>Content<br><u>2/ 3/</u> | Protein<br>Content<br><u>3/</u> |                                     |
|   |             |                                       | P.p.m.                                | Pct.                            | Units                               |
| Ld 398 x (Ld 357 <sup>2</sup> x St 464) | 60-54       | 6                                     | 5.6                                   | 14.8                            | 22                                  |
| Langdon x (Ld 357 x CI 7780 - Ld 362)   | 60-58       | 6                                     | 5.2                                   | 14.5                            | 21                                  |
| " "                                     | 60-59       | 6                                     | 5.4                                   | 14.5                            | 21                                  |
| " "                                     | 60-60       | 6                                     | 5.2                                   | 15.5                            | 21                                  |
| " "                                     | 60-62       | 8                                     | 7.1                                   | 15.5                            | 21                                  |
| Langdon x (Sentry x Ld 379 - Ld 357)    | 60-65       | 7                                     | 6.8                                   | 14.5                            | 23                                  |
| " "                                     | 60-67       | 7                                     | 5.9                                   | 15.7                            | 22                                  |
| " "                                     | 60-69       | 7                                     | 5.9                                   | 15.1                            | 24                                  |
| Langdon x (Sentry x Ld 379 - Ld 357)    | 60-70       | 7                                     | 5.9                                   | 14.6                            | 27                                  |
| Ld 382 x Langdon <sup>2</sup>           | 60-77       | 7                                     | 6.3                                   | 15.1                            | 21                                  |
| " "                                     | 60-78       | 8                                     | 6.4                                   | 15.2                            | 17                                  |
| " "                                     | 60-79       | 7                                     | 6.5                                   | 15.3                            | 16                                  |
| " "                                     | 60-80       | 8                                     | 5.7                                   | 14.6                            | 18                                  |
| " "                                     | 60-82       | 8                                     | 6.6                                   | 15.4                            | 18                                  |
| " "                                     | 60-83       | 8                                     | 6.3                                   | 15.6                            | 20                                  |
| Ld 393 x Yuma <sup>2</sup>              | 60-87       | 7                                     | 5.4                                   | 15.5                            | 21                                  |
| " "                                     | 60-89       | 7                                     | 5.7                                   | 16.1                            | 24                                  |
| Ld 393 x Langdon <sup>2</sup>           | 60-84       | 7                                     | 5.8                                   | 15.4                            | 16                                  |
| " "                                     | 60-86       | 7                                     | 6.1                                   | 15.4                            | 22                                  |
| CI 8133 x Langdon                       | 60-13       | 5                                     | 5.2                                   | 15.8                            | 24                                  |
| St 464 x Langdon                        | 60-17       | 6                                     | 4.7                                   | 15.7                            | 23                                  |
| Langdon                                 |             | 6                                     | 5.4                                   | 15.8                            | 24                                  |
| Ld 385 x Ramsey                         | 60-39       | 7                                     | 6.6                                   | 14.2                            | 22                                  |
| Ld 398 x (Ld 357 x St 464 - 357)        | 60-56       | 6                                     | 6.3                                   | 13.8                            | 18                                  |
| Langdon x (Sentry x Ld 379 - Ld 357)    | 60-72       | 8                                     | 6.3                                   | 15.8                            | 20                                  |
| " "                                     | 60-73       | 8                                     | 6.0                                   | 15.6                            | 23                                  |
| " "                                     | 60-74       | 8                                     | 5.9                                   | 15.0                            | 18                                  |
| Wells                                   |             | 9                                     | 6.6                                   | 15.4                            | 21                                  |
| Wells x Langdon                         | 60-90       | 8                                     | 7.2                                   | 14.9                            | 23                                  |
| " "                                     | 60-91       | 8                                     | 6.4                                   | 14.7                            | 26                                  |
| Wells x Br. 183                         | 60-93       | 8                                     | 6.7                                   | 15.2                            | 24                                  |
| " "                                     | 60-95       | 8                                     | 7.0                                   | 14.5                            | 27                                  |
| Wells x Br. 170                         | 60-98       | 8                                     | 7.1                                   | 14.9                            | 22                                  |
| Lakota                                  |             | 9                                     | 7.2                                   | 15.6                            | 29                                  |
| Wells x Br. 170                         | 60-100      | 8                                     | 6.8                                   | 14.8                            | 25                                  |
| " "                                     | 60-101      | 9                                     | 7.4                                   | 15.0                            | 25                                  |
| Wells x (Ld 357 x CI 7780 - Ld 362)     | 60-103      | 7                                     | 6.1                                   | 15.6                            | 21                                  |
| Ld 390 x Ramsey                         | 60-106      | 6                                     | 5.7                                   | 14.6                            | 28                                  |
| " "                                     | 60-108      | 7                                     | 6.6                                   | 15.2                            | 24                                  |
| Ld 371 - Sentry x Wells                 | 60-110      | 8                                     | 6.9                                   | 15.0                            | 18                                  |
| PI 231356 x 408                         | 60-112      | 8                                     | 6.6                                   | 15.3                            | 20                                  |
| Br. 180 x Wells                         | 60-114      | 9                                     | 7.1                                   | 15.4                            | 31                                  |
| " "                                     | 60-115      | 9                                     | 7.2                                   | 15.4                            | 27                                  |
| " "                                     | 60-116      | 7                                     | 4.8                                   | 15.1                            | 23                                  |
| Br. 180 x Lakota                        | 60-120      | 7                                     | 5.7                                   | 13.5                            | 26                                  |
| Br. 183 x Ld. 408                       | 60-124      | 8                                     | 7.2                                   | 15.5                            | 23                                  |
| Langdon <sup>2</sup> x St 464           | 60-131      | 7                                     | 5.4                                   | 14.7                            | 26                                  |
| " "                                     | 60-132      | 8                                     | 6.0                                   | 16.6                            | 25                                  |
| Ld 408 x Ld 371 - Sentry                | 60-135      | 8                                     | 7.3                                   | 14.7                            | 23                                  |
| " "                                     | 60-136      | 8                                     | 6.8                                   | 15.4                            | 26                                  |

1/ Rating based on color of macaroni product.

2/ Expressed as carotene p.p.m. water-saturated n-butyl alcohol extract.

3/ 14.0-percent moisture basis.

4/ Expressed in lipoxidase units - microliters of oxygen absorbed per minute per gram of sample.





Table 6. Quality Data of Durum Varieties Grown in Nurseries, 1961 Crop

Minnesota

| Variety or Cross | Sel. No. | Numerical Rating<br><u>1/</u> | <u>Wheat</u><br>Carotenoid Content<br><u>2/ 3/</u> |      | Protein Content<br><u>3/</u> | Semolina Lipoxidase<br><u>4/</u> |
|------------------|----------|-------------------------------|--|------|------------------------------|----------------------------------|
|                  |          |                               | P.p.m.   | Pct. |                              |                                  |
| Mindum CI 5296   |          | 8                             | 7.1  | 13.1 | 18                           |                                  |
| Langdon CI 13165 |          | 8                             | 7.6  | 14.1 | 15                           |                                  |
| Ramsey CI 13246  |          | 9                             | 8.5  | 15.7 | 16                           |                                  |
| Wells CI 13333   |          | 9                             | 8.2  | 14.0 | 16                           |                                  |
| Lakota CI 13335  |          | 9                             | 9.3  | 13.8 | 18                           |                                  |
| Ld 408 CI 13340  |          | 9                             | 9.2  | 14.5 | 15                           |                                  |
| CI 13423         | 56-1     | 10                            | 9.5  | 13.7 | 16                           |                                  |
| CI 13467         | 56-18    | 9                             | 8.2  | 13.0 | 18                           |                                  |
| CI 13468         | 5 6-17   | 9                             | 9.3  | 14.4 | 20                           |                                  |
| CI 13469         | 56-21    | 9                             | 8.6  | 14.0 | 20                           |                                  |
| CI 13470         | 56-45    | 9                             | 8.6  | 13.1 | 18                           |                                  |
| CI 13471         | 56-62    | 8                             | 7.3  | 13.9 | 16                           |                                  |
| CI 13580         | 56-50    | 9                             | 8.6  | 13.2 | 16                           |                                  |
| CI 13581         | 58-25    | 9                             | 8.8  | 14.1 | 18                           |                                  |
| CI 13582         | 58-62    | 9                             | 8.6  | 14.3 | 15                           |                                  |
| RL 3394 CI 13583 |          | 8                             | 7.3  | 14.3 | 23                           |                                  |
| Average          |          |                               | 8.8  | 13.9 | 17                           |                                  |

Crookston

|                  |       |   |      |      |    |  |
|------------------|-------|---|------|------|----|--|
| Mindum CI 5296   |       | 6 | 6.1  | 15.1 | 27 |  |
| Langdon CI 13165 |       | 7 | 6.7  | 14.8 | 21 |  |
| Ramsey CI 13246  |       | 6 | 7.1  | 15.0 | 25 |  |
| Wells CI 13333   |       | 8 | 8.4  | 15.3 | 25 |  |
| Lakota CI 13335  |       | 8 | 8.0  | 15.6 | 26 |  |
| Mindum CI 5296   |       | 6 | 6.1  | 15.1 | 27 |  |
| Langdon CI 13165 |       | 7 | 6.7  | 14.8 | 21 |  |
| Ramsey CI 13246  |       | 6 | 7.1  | 15.0 | 25 |  |
| Wells CI 13333   |       | 8 | 8.4  | 15.3 | 25 |  |
| Lakota CI 13335  |       | 8 | 8.0  | 15.6 | 26 |  |
| Ld 408 CI 13340  |       | 9 | 10.0 | 15.6 | 18 |  |
| CI 13423         | 56-1  | 9 | 9.0  | 14.8 | 25 |  |
| CI 13467         | 56-16 | 8 | 8.3  | 14.6 | 24 |  |
| CI 13468         | 56-17 | 8 | 8.4  | 15.0 | 26 |  |
| CI 13469         | 56-21 | 8 | 8.1  | 14.8 | 23 |  |
| CI 13470         | 56-45 | 8 | 8.6  | 15.3 | 21 |  |
| CI 13471         | 56-62 | 7 | 7.0  | 14.9 | 26 |  |
| CI 13580         | 56-50 | 8 | 8.8  | 14.8 | 19 |  |
| CI 13581         | 58-25 | 9 | 8.8  | 14.8 | 19 |  |
| CI 13582         | 58-62 | 9 | 8.5  | 15.2 | 18 |  |
| RL 3394          |       | 7 | 9.3  | 14.9 | 26 |  |
| Average          |       |   | 7.8  | 8.1  | 23 |  |

Morris

|                  |       |   |     |      |    |  |
|------------------|-------|---|-----|------|----|--|
| Mindum CI 5296   |       | 7 | 8.3 | 14.6 | 22 |  |
| Langdon CI 13165 |       | 7 | 8.5 | 14.5 | 22 |  |
| Ramsey CI 13246  |       | 7 | 6.3 | 14.3 | 19 |  |
| Wells CI 13333   |       | 8 | 6.9 | 15.0 | 25 |  |
| Lakota CI 13335  |       | 9 | 7.1 | 15.2 | 22 |  |
| Ld 408 CI 13340  |       | 8 | 7.8 | 15.3 | 16 |  |
| CI 13423         | 56-1  | 9 | 7.8 | 15.0 | 23 |  |
| CI 13467         | 56-16 | 8 | 7.0 | 15.2 | 26 |  |
| CI 13468         | 56-17 | 8 | 6.7 | 15.0 | 22 |  |
| CI 13469         | 56-21 | 8 | 6.7 | 14.8 | 18 |  |
| CI 13470         | 56-45 | 8 | 7.4 | 14.8 | 19 |  |
| CI 13471         | 56-62 | 7 | 6.0 | 14.7 | 25 |  |
| CI 13580         | 56-50 | 7 | 6.9 | 14.7 | 21 |  |
| CI 13581         | 58-25 | 8 | 7.2 | 14.9 | 19 |  |
| CI 13582         | 58-62 | 8 | 7.1 | 15.4 | 16 |  |
| RL 3394 CI 13583 |       | 7 | 5.7 | 14.9 | 25 |  |
| Average          |       |   | 7.1 | 14.9 | 21 |  |

1/ Rating based on color of macaroni product.

2/ Expressed as carotene p.p.m. water-saturated n-butyl alcohol extract.

3/ 14.0=percent moisture basis.

4/ Expressed in lipoxidase units - microliters of oxygen absorbed per minute per gram of sample.



Table 6. Averages of 3 Stations

Continued

| Variety or<br>Cross | Sel.<br>No. | Numerical<br>Rating | Wheat                 |    | Protein<br>Content<br>3/ | Semolina<br>Lipoxidase<br>4/ |
|---------------------|-------------|---------------------|-----------------------|----|--------------------------|------------------------------|
|                     |             |                     | Carotenoid<br>Content |    |                          |                              |
|                     |             |                     | 2/                    | 3/ |                          |                              |
| Mindum              |             | 7                   | 7.2                   |    | 14.27                    | 22                           |
| Langdon             |             | 7.3                 | 7.6                   |    | 14.27                    | 19                           |
| Ramsey              |             | 7.3                 | 7.5                   |    | 15.00                    | 20                           |
| Wells               |             | 8.3                 | 7.5                   |    | 14.77                    | 22                           |
| Lakota              |             | 8.7                 | 8.1                   |    | 14.87                    | 22                           |
| Ld 408              |             | 8.7                 | 9.0                   |    | 15.20                    | 16                           |
| C.I. 13423          | 56-1        | 9.3                 | 8.8                   |    | 14.50                    | 21                           |
| C.I. 13467          | 56-16       | 8.3                 | 7.8                   |    | 14.27                    | 23                           |
| C.I. 13468          | 56-17       | 8.3                 | 8.1                   |    | 14.80                    | 23                           |
| C.I. 13469          | 56-21       | 8.3                 | 7.8                   |    | 14.53                    | 20                           |
| C.I. 13470          | 56-45       | 8.3                 | 8.2                   |    | 14.40                    | 19                           |
| C.I. 13471          | 56-62       | 7.3                 | 6.8                   |    | 14.50                    | 22                           |
| C.I. 13580          | 56-50       | 8.0                 | 8.1                   |    | 14.23                    | 19                           |
| C.I. 13581          | 58-25       | 8.7                 | 8.3                   |    | 14.60                    | 19                           |
| C.I. 13582          | 58-62       | 8.7                 | 8.1                   |    | 14.97                    | 16                           |
| RL 3394             | 58-62       | 7.3                 | 7.4                   |    | 14.70                    | 25                           |

1/ Rating based on color of macaroni product.

2/ Expressed as carotene p.p.m. water-saturated n-butyl alcohol extract.

3/ 14.0 percent moisture basis.

4/ Expressed in lipoxidase units - microliters of oxygen absorbed per minute per gram of sample.





Table 7. Quality Data of Durum Varieties Grown in Nurseries, 1961 Crop

South Dakota

| Variety or Cross | Sel.<br>No. | Numeri-<br>cal<br>Rating | Wheat                                |                          |
|------------------|-------------|--------------------------|--------------------------------------|--------------------------|
|                  |             |                          | Carotenoid<br>Content<br>2/ 3/<br>1/ | Protein<br>Content<br>3/ |
|                  |             |                          | P.p.m.                               | Pct.                     |
| <u>Brookings</u> |             |                          |                                      |                          |
| Ramsey           |             | 8                        | 6.4                                  | 12.8                     |
| Langdon          |             | 8                        | 5.8                                  | 12.8                     |
| Wells            |             | 8                        | 6.9                                  | 13.6                     |
| Lakota           |             | 8                        | 6.8                                  | 13.6                     |
| Mindum           |             | 6                        | 5.6                                  | 13.1                     |
| Yuma             |             | 7                        | 6.0                                  | 13.6                     |
| Ld 408           |             | 8                        | 6.8                                  | 12.6                     |
|                  | 56-45       | 8                        | 6.5                                  | 13.4                     |
|                  | 56-62       | 7                        | 5.4                                  | 13.0                     |
|                  | 56-16       | 8                        | 6.9                                  | 13.2                     |
|                  | 56-21       | 8                        | 7.5                                  | 13.6                     |
|                  | 56-17       | 7                        | 6.6                                  | 12.9                     |
|                  | 56-50       | 8                        | 6.9                                  | 13.6                     |
|                  | 58-25       | 9                        | 6.4                                  | 13.7                     |
| RL 3394          |             | 7                        | 6.3                                  | 13.5                     |
|                  | 58-62       | 7                        | 6.0                                  | 13.8                     |
|                  | 56-1        | 8                        | 7.7                                  | 13.3                     |
| Sentry           |             | 8                        | 6.2                                  | 14.3                     |
|                  | Average     | 7.7                      | 6.5                                  | 13.4                     |
| <u>Watertown</u> |             |                          |                                      |                          |
| Ramsey           |             | 8                        | 6.6                                  | 16.1                     |
| Langdon          |             | 9                        | 6.6                                  | 16.0                     |
| Wells            |             | 10                       | 7.7                                  | 17.2                     |
| Lakota           |             | 10                       | 8.2                                  | 17.1                     |
| Mindum           |             | 8                        | 9.5                                  | 16.3                     |
| Yuma             |             | 8                        | 7.0                                  | 16.5                     |
| Ld 408           |             | 10                       | 8.6                                  | 16.4                     |
|                  | 56-45       | 10                       | 8.0                                  | 16.2                     |
|                  | 56-62       | 9                        | 7.0                                  | 16.8                     |
|                  | 56-16       | 10                       | 7.9                                  | 16.9                     |
|                  | 56-21       | 8                        | 7.9                                  | 16.4                     |
|                  | 56-17       | 9                        | 7.9                                  | 16.5                     |
|                  | 56-50       | 9                        | 8.0                                  | 15.7                     |
|                  | 58-25       | 8                        | 8.0                                  | 16.0                     |
| RL 3394          |             | 8                        | 6.7                                  | 16.9                     |
| 58-62            |             | 9                        | 7.7                                  | 16.8                     |
| Sentry           |             | 9                        | 7.3                                  | 16.4                     |
|                  | Average     | 8.9                      | 7.7                                  | 16.5                     |
| <u>Richmore</u>  |             |                          |                                      |                          |
| Ramsey           |             | 8                        | 5.4                                  | 18.4                     |
| Langdon          |             | 8                        | 5.7                                  | 16.6                     |
| Wells            |             | 9                        | 6.3                                  | 17.6                     |
| Lakota           |             | 10                       | 7.0                                  | 17.8                     |
| Mindum           |             | 8                        | 5.3                                  | 18.8                     |
| Yuma             |             | 6                        | 6.0                                  | 19.1                     |
| Ld 408           |             | 10                       | 7.8                                  | 18.6                     |
|                  | 56-45       | 9                        | 6.6                                  | 17.9                     |
|                  | 56-62       | 7                        | 5.4                                  | 18.1                     |
|                  | 56-16       | 8                        | 6.5                                  | 17.9                     |
|                  | 56-21       | 9                        | 6.5                                  | 18.1                     |
|                  | 56-17       | 8                        | 6.5                                  | 18.8                     |
|                  | 56-50       | 9                        | 6.7                                  | 17.6                     |
|                  | 58-25       | 9                        | 6.7                                  | 18.0                     |
| RL 3394          |             | 8                        | 6.2                                  | 18.2                     |
|                  | 58-62       | 8                        | 5.8                                  | 18.2                     |
|                  | 56-1        | 10                       | 6.9                                  | 18.6                     |
|                  | Average     | 8.5                      | 6.3                                  | 18.1                     |

1/ Rating based on color of macaroni product.

2/ Expressed as carotene p.p.m. water-saturated n-butyl alcohol extract.

3/ 14.0-percent moisture basis.

4/ Expressed in lipoxidase units - microliters of oxygen absorbed per minute per gram of sample.



Table 7. Quality Data of Durum Varieties Grown in Nurseries, 1961 Crop

South Dakota  
(Continued)

| Variety or Cross     | Sel.<br>No. | Numeri-<br>cal<br>Rating | <u>Wheat</u><br>Carotenoid<br>Content |          | Protein<br>Content |
|----------------------|-------------|--------------------------|---------------------------------------|----------|--------------------|
|                      |             |                          | <u>2</u>                              | <u>3</u> |                    |
|                      |             | <u>1</u>                 |                                       |          | <u>3</u>           |
| <u>Eureka</u>        |             |                          |                                       |          |                    |
| Ramsey               |             | 7                        | 5.3                                   |          | 17.5               |
| Langdon              |             | 7                        | 5.6                                   |          | 17.8               |
| Wells                |             | 7                        | 6.4                                   |          | 18.6               |
| Lakota               |             | 10                       | 6.6                                   |          | 18.9               |
| Mindum               |             | 6                        | 5.0                                   |          | 17.7               |
| Yuma                 |             | 6                        | 5.2                                   |          | 18.1               |
| Ld 408               |             | 9                        | 6.8                                   |          | 18.8               |
|                      | 56-45       | 10                       | 6.9                                   |          | 16.9               |
|                      | 56-62       | 6                        | 5.2                                   |          | 17.4               |
|                      | 56-16       | 9                        | 5.9                                   |          | 17.6               |
|                      | 56-21       | 9                        | 6.1                                   |          | 17.3               |
|                      | 56-17       | 9                        | 6.2                                   |          | 17.4               |
|                      | 56-50       | 10                       | 6.1                                   |          | 17.0               |
|                      | 58-25       | 10                       | 7.3                                   |          | 17.2               |
| RL 3394              |             | 10                       | 6.7                                   |          | 17.7               |
|                      | 58-62       | 8                        | 5.9                                   |          | 17.7               |
|                      | 56-1        | <u>9</u>                 | <u>6.9</u>                            |          | <u>17.1</u>        |
|                      | Average     | 8.4                      | 6.2                                   |          | 17.7               |
| Averages, 4 Stations |             |                          |                                       |          |                    |
| Lakota               |             | 9.5                      | 7.2                                   |          | 16.8               |
| Ld 408               |             | 9.2                      | 7.5                                   |          | 16.6               |
| C.I. 13423           | 56-1        | 9.2                      | 7.6                                   |          | 16.4               |
| C.I. 13470           | 56-45       | 9.2                      | 7.0                                   |          | 16.1               |
| C.I. 13580           | 56-50       | 9.0                      | 6.9                                   |          | 16.0               |
| C.I. 13581           | 58-25       | 9.0                      | 7.1                                   |          | 16.2               |
| Wells                |             | 8.8                      | 6.8                                   |          | 16.8               |
| C.I. 13467           | 56-16       | 8.8                      | 6.8                                   |          | 16.4               |
| C.I. 13469           | 56-21       | 8.5                      | 7.0                                   |          | 16.4               |
| C.I. 13468           | 56-17       | 8.2                      | 6.8                                   |          | 16.4               |
| RL 3394              |             | 8.2                      | 7.5                                   |          | 16.6               |
| Langdon              |             | 8.0                      | 5.9                                   |          | 15.8               |
| C.I. 13582           | 58-62       | 8.0                      | 6.2                                   |          | 16.6               |
| Ramsey               |             | 7.8                      | 5.9                                   |          | 16.2               |
| C.I. 13471           | 56-62       | 7.2                      | 5.8                                   |          | 16.3               |
| Mindum               |             | 7.0                      | 6.6                                   |          | 16.5               |
| Yuma                 |             | 6.8                      | 6.2                                   |          | 16.8               |

1/ Rating based on color of macaroni product.

2/ Expressed as carotene p.p.m. water-saturated n-butyl alcohol extract.

3/ 14.0-percent moisture basis.





Table 8. Quality Data of Durum Varieties Grown in Nurseries, 1961 Crop

Lind, Washington

| Variety or Cross                                 |            | Sel. No. | Numerical Rating<br><u>1/</u> | Wheat Carotenoid Content<br><u>2/ 3/</u> | Protein Content<br><u>3/</u> |
|--|------------|----------|-------------------------------|--|------------------------------|
|  |            |          |                               | P.p.m.                                   | Pct.                         |
| Mindum   | C.I. 5296  |          | 8                             | 5.3                                      | 16.6                         |
| Langdon  | C.I. 13165 |          | 9                             | 6.1                                      | 16.6                         |
| Ramsey   | C.I. 13246 |          | 9                             | 5.9                                      | 16.3                         |
| Wells  | C.I. 13333 |          | 10                            | 7.3                                      | 16.5                         |
| Lakota   | C.I. 13335 |          | 10                            | 7.3                                      | 16.6                         |
| Sentry   | C.I. 13102 |          | 10                            | 6.6                                      | 16.8                         |
| Ld 408   | C.I. 13340 |          | 10                            | 7.7                                      | 15.5                         |
|  | C.I. 13423 | 56-1     | 10                            | 8.0                                      | 16.5                         |
|  | C.I. 13467 | 56-16    | 10                            | 7.1                                      | 16.7                         |
|  | C.I. 13468 | 56-17    | 10                            | 7.2                                      | 16.7                         |
|  | C.I. 13469 | 56-21    | 8                             | 6.7                                      | 16.3                         |
|  | C.I. 13470 | 56-45    | 10                            | 7.7                                      | 15.7                         |
|  | C.I. 13471 | 56-62    | 10                            | 6.0                                      | 15.9                         |
|  | C.I. 13580 | 56-50    | 9                             | 7.3                                      | 15.8                         |
| Ld 308 x Nugget - Ld 357                         |            |          | 10                            | 7.9                                      | 16.6                         |
| Ld 357 <sup>2</sup> x RL 1714 - Ld 357           |            | 57-150   | 9                             | 7.7                                      | 15.8                         |
| Ld 357 x Ld 366                                  |            | 57-96    | 10                            | 7.5                                      | 16.3                         |
| Ld 394 x Ld 357 <sup>2</sup> - St. 464           |            | 58-272   | 10                            | 7.7                                      | 17.1                         |
| Ld 357 <sup>2</sup> x C.I. 7513 - Ld 362         |            | 57-180   | 9                             | 7.7                                      | 15.7                         |
| Ld 357 <sup>2</sup> x RL 1714 - Ld 357           |            | 57-145   | 9                             | 6.6                                      | 16.0                         |
| Ld 357 x (Ld 357 x St. 464-Ld 357)               |            | 58-158   | 10                            | 7.5                                      | 15.9                         |
| Ld 371 x Sentry                                  |            | 56-70    | 8                             | 6.5                                      | 16.3                         |
| Ld 357 <sup>2</sup> x C.I. 7513 - Ld 362         |            | 58-108   | 8                             | 7.0                                      | 16.8                         |
| Ld 357 <sup>2</sup> x C.I. 7518 - Ld 362         |            | 57-181   | 9                             | 6.4                                      | 15.4                         |
| Ld 357 <sup>2</sup> x C.I. 7516                  |            | 57-114   | 10                            | 6.3                                      | 14.8                         |
| Ld 393 x Langdon                                 |            | 58-319   | 9                             | 6.8                                      | 16.3                         |
| Ld 357 <sup>2</sup> x C.I. 7814                  |            | 57-121   | 8                             | 5.9                                      | 16.5                         |
| Ld 357 x Ld 366                                  |            | 57-97    | 10                            | 7.5                                      | 15.9                         |
| Ld 382 x Langdon                                 |            | 58-317   | 9                             | 6.1                                      | 16.2                         |
| Ld 357 <sup>2</sup> x RL 1714 - Ld 357           |            | 58-75    | 10                            | 7.6                                      | 16.0                         |
| Ld 357 <sup>2</sup> x C.I. 7513 - Ld 362         |            | 57-179   | 9                             | 7.4                                      | 15.7                         |
| Nugget x Ld 371 - Ld 408                         |            |          | 9                             | 8.2                                      | 15.3                         |
| Ld 394 x (Ld 357 <sup>2</sup> x St. 464)         |            | 58-274   | 8                             | 7.2                                      | 16.8                         |
| Sentry x (Ld 340 x K.D.C. -Carl)                 |            |          |                               |  |                              |
|  | Ld 357     | 57-1     | 10                            | 7.9                                      | 16.9                         |
| Ld 388 x (Ld 357 <sup>2</sup> x St.464-Ld 357)   |            | 58-253   | 9                             | 6.5                                      | 15.8                         |
| Ld 394 x (Ld 357 <sup>2</sup> x St. 464)         |            | 58-275   | 10                            | 6.7                                      | 16.9                         |
| Ld 366 <sup>2</sup> x (C.I. 7744-Ld 362)         |            | 58-221   | 7                             | 5.0                                      | 16.3                         |
| Ld 357 <sup>4</sup> x (St. 464-Ld 357)           |            | 56-55    | 9                             | 7.6                                      | 15.6                         |
| Ld 357 <sup>4</sup> x (St. 464-Ld 357)           |            | 56-49    | 10                            | 7.9                                      | 16.0                         |
| Ld 357 <sup>4</sup> x (St. 464-Ld 357)           |            | 56-35    | 10                            | 7.9                                      | 16.1                         |
| Ld 357 <sup>4</sup> x (St. 464-Ld 357)           |            | 56-57    | 9                             | 7.3                                      | 15.4                         |
| Ld 357 <sup>3</sup> x (St. x P.I. 192179-Ld 357) |            | 56-3     | 9                             | 6.5                                      | 16.2                         |
| Sentry x (Ld 340 x K.D.C.-Carl)                  |            |          |                               |  |                              |
|  | Ld 357     | 57-8     | 9                             | 7.2                                      | 17.1                         |
| Ld 357 <sup>4</sup> x (SL x P.I. 192179-Ld357)   |            | 56-14    | 9                             | 7.2                                      | 16.2                         |
| Ld 357 <sup>4</sup> x (SL x P.I. 192179-Ld357)   |            | 56-7     | 9                             | 7.7                                      | 16.3                         |

1/ Rating based on color of macaroni product.

2/ Expressed as carotene p.p.m. water-saturated n-butyl alcohol extract.

3/ 14.0-percent moisture basis.



Table 9. Some Quality Characteristics of Durum Wheat Grown in State Nursery Trials in 1961.

Washington - Two levels of Fertilization<sup>1/</sup>

| Variety or Cross                                      | Sel.<br>No. | Fertilized as usual                   |                                       |                                 | Additional Fertilizer - 30 lbs. per acre |                                       |                                 |
|---|-------------|---------------------------------------|---------------------------------------|---------------------------------|--|---------------------------------------|---------------------------------|
|   |             | Numeri-<br>cal<br>Rating<br><u>2/</u> | Wheat                                 |                                 | Numeri-<br>cal<br>Rating<br><u>2/</u>    | Wheat                                 |                                 |
|   |             |                                       | Carotenoid<br>Content<br><u>3/ 4/</u> | Protein<br>Content<br><u>4/</u> |  | Carotenoid<br>Content<br><u>3/ 4/</u> | Protein<br>Content<br><u>4/</u> |
|   |             |                                       |                                       |                                 |  |                                       |                                 |
| <u>Pullman</u>  |             |                                       |                                       |                                 |  |                                       |                                 |
| Ld 357 x (St.xP.I. 192179-Ld357)                      | 56-14       | 10                                    | 8.8                                   | 13.2                            | 10                                       | 8.9                                   | 13.4                            |
| St. x (Ld 340 x K.D.C.-Carl)                          | LD357 57-1  | 10                                    | 9.0                                   | 13.1                            | 10                                       | 9.0                                   | 13.8                            |
| Sentry x (Ld 340 x K.D.C.-Carl)                       |             |                                       |                                       |                                 |  |                                       |                                 |
|   | Ld 357 57-8 | 10                                    | 8.9                                   | 13.1                            | 10                                       | 8.6                                   | 13.5                            |
| Ld 394 <sup>2</sup> x (Ld 357 <sup>2</sup> x St. 464) | 58-275      | 9                                     | 8.6                                   | 12.9                            | 9  | 8.4                                   | 13.1                            |
| Ld 357 <sup>2</sup> x C.I. 7512-Ld 362                | 58-108      |                                       |                                       |                                 | 9  | 8.4                                   | 14.8                            |
| Ld 388 <sup>2</sup> x (Ld 357 x St. 464-Ld357)        | 58-253      | 9                                     | 7.7                                   | 13.9                            | 9  | 7.7                                   | 13.9                            |
| Ld 357 <sup>2</sup> x C.I. 7513-Ld 362                | 57-179      | 10                                    | 9.1                                   | 13.9                            | 10                                       | 9.0                                   | 13.8                            |
| Ld 357 <sup>2</sup> x R.L. 1714-Ld 357                | 57-145      | 10                                    | 8.2                                   | 13.3                            | 10                                       | 7.9                                   | 14.1                            |
| Ld 382 <sup>4</sup> x Langdon                         | 58-312      | 8                                     | 7.6                                   | 12.4                            | 8  | 7.6                                   | 12.6                            |
| Ld 357 <sup>4</sup> x (St 464-Ld 357)                 | 56-49       |                                       |                                       |                                 | 10                                       | 8.8                                   | 14.1                            |
| Ld 357 x (Ld 357 x St.464-Ld 357)                     | 58-198      | 10                                    | 9.1                                   | 14.1                            | 10                                       | 9.1                                   | 14.4                            |
| Sentry  |             | 10                                    | 7.7                                   | 14.3                            | 10                                       | 7.7                                   | 14.6                            |
| Langdon   |             | 10                                    | 7.4                                   | 13.3                            | 9  | 7.2                                   | 13.3                            |
| Ld 357  |             | 10                                    | 8.9                                   | 13.3                            | 10                                       | 9.1                                   | 13.9                            |
| RL 3207 x Langdon                                     | 57-101      | 10                                    | 9.1                                   | 13.8                            | 10                                       | 8.8                                   | 13.9                            |
| Ld 357 <sup>4</sup> x RL 1714 Ld 357                  | 58-75       | 10                                    | 9.1                                   | 13.4                            | 10                                       | 8.8                                   | 13.8                            |
| Ld 357 <sup>4</sup> x (St. 464 - Ld 357)              | 56-45       | 10                                    | 9.0                                   | 13.3                            | 10                                       | 8.6                                   | 13.5                            |
| Ld 371 x Sentry                                       | 56-70       | 10                                    | 8.8                                   | 13.1                            | 10                                       | 8.7                                   | 13.3                            |
| Ld 357 x Ld 366                                       | 57-97       | 9                                     | 8.2                                   | 13.4                            | 10                                       | 8.4                                   | 13.6                            |
| Wells   |             | 9                                     | 8.1                                   | 13.7                            | 10                                       | 8.1                                   | 13.9                            |
| Lakota  |             | <u>10</u>                             | <u>8.0</u>                            | <u>13.8</u>                     | <u>10</u>                                | <u>7.9</u>                            | <u>14.5</u>                     |
| Average   |             | 9.7                                   | 8.5                                   | 13.4                            | 9.7                                      | 8.4                                   | 13.8                            |
| <u>Dusty</u>  |             |                                       |                                       |                                 |  |                                       |                                 |
| Sentry  |             | 9                                     | 6.7                                   | 15.2                            | 10                                       | 6.8                                   | 15.7                            |
| Lakota  |             | 10                                    | 7.4                                   | 14.9                            | 10                                       | 7.6                                   | 15.2                            |
| Wells   |             | <u>10</u>                             | <u>7.5</u>                            | <u>14.7</u>                     | <u>10</u>                                | <u>7.7</u>                            | <u>14.8</u>                     |
| Average   |             | 9.7                                   | 7.2                                   | 14.9                            | 10                                       | 7.4                                   | 15.2                            |
| <u>Pomeroy</u>  |             |                                       |                                       |                                 |  |                                       |                                 |
| Sentry  |             | 9                                     | 7.0                                   | 15.2                            | 10                                       | 7.0                                   | 15.0                            |
| Lakota  |             | 10                                    | 7.9                                   | 14.7                            | 10                                       | 8.0                                   | 15.1                            |
| Wells   |             | <u>9</u>                              | <u>7.7</u>                            | <u>14.0</u>                     | <u>10</u>                                | <u>8.0</u>                            | <u>14.5</u>                     |
| Average   |             | 9.3                                   | 7.5                                   | 14.6                            | 10                                       | 7.7                                   | 15.5                            |
| <u>Walla Walla</u>                                    |             |                                       |                                       |                                 |  |                                       |                                 |
| Sentry  |             | 9                                     | 6.8                                   | 15.9                            | 10                                       | 7.2                                   | 16.3                            |
| Lakota  |             | 10                                    | 7.9                                   | 16.3                            | 10                                       | 7.7                                   | 16.9                            |
| Wells   |             | <u>9</u>                              | <u>8.1</u>                            | <u>16.0</u>                     | <u>10</u>                                | <u>8.1</u>                            | <u>16.5</u>                     |
| Average   |             | 9.3                                   | 7.6                                   | 16.1                            | 10                                       | 7.7                                   | 16.6                            |

<sup>1/</sup> Standard practice of adding fertilizer - all plots. Then, 30 pounds of ammonia nitrate per acre added to half of the plots.

<sup>2/</sup> Rating based on color of macaroni product.

<sup>3/</sup> Expressed as carotene p.p.m. water-saturated n-butyl alcohol extract.

<sup>4/</sup> 14.0 percent moisture basis.





Table 10. Numerical Color Scores of Some Varieties Grown Uniformly  
at the Stations of Minnesota, South Dakota and  
Washington, 1961 Crop

| Variety<br>C.I. or Selection<br>Number | Minnesota |           |        | South Dakota |           |          | Washington |      |                            |
|--|-----------|-----------|--------|--------------|-----------|----------|------------|------|----------------------------|
|  | St. Paul  | Crookston | Morris | Brookings    | Watertown | Highmore | Eureka     | Lind | Average<br>All<br>Stations |
| Lakota                                 |           |           |        |              |           |          |            |      |                            |
| C.I. 13423                             | 9         | 8         | 9      | 8            | 10        | 10       | 10         | 10   | 9.2                        |
| C.I. 13470                             | 10        | 9         | 9      | 8            | 9         | 10       | 9          | 10   | 9.2                        |
| C.I. 13470                             | 9         | 8         | 8      | 10           | 10        | 9        | 10         | 10   | 9.2                        |
| C.I. 13340                             | 9         | 9         | 8      | 8            | 8         | 10       | 9          | 10   | 9.1                        |
| C.I. 13581                             | 9         | 9         | 8      | 9            | 8         | 9        | 10         | --   | 8.9                        |
| C.I. 13467                             | 9         | 8         | 8      | 8            | 10        | 8        | 9          | 10   | 8.8                        |
| Wells                                  | 9         | 8         | 8      | 8            | 10        | 9        | 7          | 10   | 8.6                        |
| C.I. 13580                             | 9         | 8         | 7      | 8            | 9         | 9        | 10         | 9    | 8.6                        |
| C.I. 13468                             | 9         | 8         | 8      | 7            | 9         | 8        | 9          | 10   | 8.5                        |
| C.I. 13469                             | 9         | 8         | 8      | 8            | 8         | 9        | 9          | 8    | 8.4                        |
| C.I. 13582                             | 9         | 9         | 8      | 7            | 9         | 8        | 8          | --   | 8.3                        |
| Langdon                                | 8         | 7         | 7      | 8            | 9         | 8        | 7          | 9    | 7.9                        |
| C.I. 13471                             | 8         | 7         | 7      | 9            | 9         | 7        | 6          | 10   | 7.9                        |
| C.I. 13583                             | 8         | 7         | 7      | 7            | 8         | 8        | 10         | --   | 7.9                        |
| Ramsey                                 | 9         | 6         | 7      | 8            | 8         | 8        | 7          | 9    | 7.8                        |
| Mindum                                 | 8         | 6         | 7      | 6            | 8         | 8        | 6          | 8    | 7.1                        |
| Average                                | 8.8       | 7.8       | 7.8    | 7.9          | 9.0       | 8.6      | 8.5        | 9.5  | 8.5                        |
| Yuma                                   | --        | --        | --     | 7            | 8         | 6        | 6          | --   | --                         |
| Sentry                                 | --        | --        | --     | 8            | 9         | --       | --         | 10   | 10                         |



Table 11. Quality Characteristics of Six Commercial Composites of Durum Wheat Obtained at Minneapolis and Duluth, Minnesota 1961 Crops

| U.S. Grade  | No. of Cars | Test Weight | 1000 Kernel Weight | Damaged Kernels | Hard and Vitrified Kernels | Yield of Semo-lina <sup>1</sup> / <sub>4</sub> | Fat Acidity | Protein <sup>2</sup> / <sub>Content</sub> |                 | Ash <sup>2</sup> / <sub>Wheat Semo-lina</sub> |                 | Carotenoid <sup>3</sup> / <sub>Content</sub> |  | Absorp-tion | Lipoxi-dase Semo-lina <sup>4</sup> / <sub>4</sub> | Numeri-cal Rating | Macaroni Cooking |      |       |      |
|---|-------------|-------------|--------------------|-----------------|----------------------------|--|-------------|---|-----------------|---|-----------------|--|--|-------------|---|-------------------|------------------|------|-------|------|
|   |             |             |                    |                 |                            |  |             | Wheat Semo-lina                           | Wheat Semo-lina | Wheat Semo-lina                               | Wheat Semo-lina | Weight Gain <sup>5</sup> / <sub>due</sub>    | Firm-ness Values <sup>8</sup> / <sub>7</sub> |             |   |                   |                  |      |       |      |
| Lbs.  | Gram        | Pct.        | Pct.               | Pct.            | Pct.                       | Pct.   | Pct.        | Pct.                                      | Pct.            | Pct.  | Pct.            | p.p.m.                                       | p.p.m.                                       | Pct.        | Units   | Score             | Pct.             | Pct. | Grams |      |
| <u>Minneapolis</u>  |             |             |                    |                 |                            |  |             |   |                 |   |                 |  |  |             |   |                   |                  |      |       |      |
| 1 HAD 36  | 62.2        | 37.4        | 0.5                | 93.0            | 47.3                       | 17   | 15.1        | 13.6                                      | 1.37            | 0.61  | 5.6             | 4.8  | 3.2  | 33          | 25.8  | 10                | 7.5              | 339  | 5.6   | 1250 |
| <u>Duluth</u>   |             |             |                    |                 |                            |  |             |   |                 |   |                 |  |  |             |   |                   |                  |      |       |      |
| 1 HAD 42  | 61.8        | 36.4        | 1.2                | 90.0            | 50.3                       | 20   | 14.5        | 13.5                                      | 1.44            | 0.68  | 5.8             | 5.1  | 2.9  | 43          | 25.0  | 13                | 7.5              | 338  | 5.6   | 1385 |
| 2 HAD 82  | 61.3        | 36.4        | 4.0                | 90.0            | 52.4                       | 22   | 14.5        | 13.6                                      | 1.57            | 0.69  | 5.9             | 5.3  | 2.9  | 45          | 25.0  | 15                | 7.0              | 332  | 5.6   | 1299 |
| 3 HAD 139   | 61.6        | 37.0        | 4.5                | 84.0            | 51.6                       | 20   | 14.6        | 13.8                                      | 1.45            | 0.65  | 5.6             | 5.1  | 2.7  | 47          | 25.0  | 18                | 7.0              | 323  | 5.2   | 1504 |
| 4 HAD 64  | 61.3        | 36.4        | 9.0                | 82.0            | 49.9                       | 25   | 14.7        | 13.6                                      | 1.47            | 0.67  | 5.6             | 4.9  | 2.9  | 41          | 25.0  | 15                | 7.0              | 330  | 5.2   | 1363 |
| 3 HAD 38  | 61.0        | 37.8        | 6.4                | 70.0            | 53.2                       | 24   | 12.7        | 12.3                                      | 1.43            | 0.66  | 5.2             | 4.5  | 2.9  | 36          | 25.0  | 9                 | 7.5              | 337  | 5.2   | 992  |
| 1/ Moisture free basis.   |             |             |                    |                 |                            |  |             |   |                 |   |                 |  |  |             |   |                   |                  |      |       |      |
| 2/ 14% moisture basis.  |             |             |                    |                 |                            |  |             |   |                 |   |                 |  |  |             |   |                   |                  |      |       |      |
| 3/ Expressed as carotene, parts per million, water saturated n-butyl alcohol extract. |             |             |                    |                 |                            |  |             |   |                 |   |                 |  |  |             |   |                   |                  |      |       |      |
| 4/ Expressed as micro-liters of oxygen taken up per minute per gram of sample.        |             |             |                    |                 |                            |  |             |   |                 |   |                 |  |  |             |   |                   |                  |      |       |      |
| 5/ Best is rated 10.  |             |             |                    |                 |                            |  |             |   |                 |   |                 |  |  |             |   |                   |                  |      |       |      |
| 6/ Water absorbed in cooking.   |             |             |                    |                 |                            |  |             |   |                 |   |                 |  |  |             |   |                   |                  |      |       |      |
| 7/ Material deposited in cooking water.   |             |             |                    |                 |                            |  |             |   |                 |   |                 |  |  |             |   |                   |                  |      |       |      |
| 8/ Grams pressure required to crush 30 mm length of cooked macaroni.                  |             |             |                    |                 |                            |  |             |   |                 |   |                 |  |  |             |   |                   |                  |      |       |      |

1/ Moisture free basis.

2/ 14% moisture basis.

3/ Expressed as carotene, parts per million, water saturated n-butyl alcohol extract.

4/ Expressed as micro-liters of oxygen taken up per minute per gram of sample.

5/ Best is rated 10.

6/ Water absorbed in cooking.

7/ Material deposited in cooking water.

8/ Grams pressure required to crush 30 mm length of cooked macaroni.

